AD-A219 900

CONTROL DATA

REFERRAL

DIRECTORY

SYSTEM

SPECIFICATION

DTIC

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APR 11 1990

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Contract No. MDA903-88-C-0186

Task Order 6

March 30, 1990

Prepared by:

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90 04 11 001

REPORT DOCUMENTATION PAGE

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE 900330	3. REPORT TYPE AND DATES COVERED Final

4. TITLE AND SUBTITLE	5. FUNDING NUMBERS
Referral Directory System Specification	MDA903-88-C-0186

6. AUTHOR(S)

Jonathan Krueger

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
Control Data Corporation 4900 Seminary Road, Suite 1000 Alexandria, VA 22311	Task #6

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSORING/MONITORING AGENCY REPORT NUMBER
Defense Technical Information Center Cameron Station Alexandria, VA 23304-6145	DTIC/TR-90/2

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT	12b. DISTRIBUTION CODE
Approved for public release: Distribution unlimited	

13. ABSTRACT (Maximum 200 words)

This document provides a system specification of DTIC's Referral Directory which is an online index to activities such as specialized libraries, testing facilities, repositories, laboratories, information centers and research facilities. It leads users to activities appropriate to their needs. The system specification is organized according to the DLA ADS Life Cycle Management Specifications. Narrative and graphic descriptions of both the existing Referral Data Bank and the proposed Referral Directory are included.

14. SUBJECT TERMS—*Archives: *Directories: Documents: Information Retrieval: *Laboratories: *Libraries: Literature Surveys: Military Publications: Newspapers: Periodicals: Records: *Reports Research Facilities: *Scientific Literature: *Technical (cont.)	15. NUMBER OF PAGES 77
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT UNCLAS/UNLIMITED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLAS/UNLIMITED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLAS/UNLIMITED	20. LIMITATION OF ABSTRACT

Information Centers: *Technology Transfer: *Test Facilities: *Test and
Evaluation: Theses: Translations , (S·   ⁻ʳ

REFERRAL DIRECTORY SYSTEM SPECIFICATIONS

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REFERRAL DIRECTORY SYSTEM SPECIFICATION

1 GENERAL

This section provides basic information relating to the Referral Directory Subsystem, including its purpose, use, sponsors, users, and developers.

1.1 Purpose of the Subsystem Specification

This Subsystem Specification is a technical document which provides a detailed definition of the Referral Directory Subsystem functions for systems personnel . The Referral Directory is a subsystem of the Directory of Resources. The Referral Directory Subsystem includes five major components: the database, the Online Retrieval System, the Input/Editing system, the tape generation procedure for input to the Technical Reports (TR) database, and generation of the hardcopy Referral Data Bank Directory.

This Subsystem Specification is prepared in accordance with the DLA ADS Life Cycle Management (LCM) Specifications and is written to fulfill the following objectives:

a. To provide a detailed definition of the subsystem functions.

b. To communicate details of the on-going analysis between DTIC operational personnel and the appropriate development personnel.

c. To define in detail the interfaces with other systems and subsystems and the facilities to be utilized for accomplishing the interfaces.

The user organization will consist of subscribers to the DoD Gateway Information System (DGIS) and users of Defense Technical Information Center (DTIC) products and services. The developer organization will be DTIC, who will expand present referral services to include online search and display. Developmental assistance in database design and implementation, and user interface development and customization, will be provided by a contractor.

The Subsystem Specification will serve as a guide for systems analysis, software selection, and programming tasks throughout the remaining development of the Referral Directory Subsystem. The inputs, outputs, structure charts, interfaces, and report formats contained in the Subsystem Specification will provide the necessary detailed understanding of the Referral Directory Subsystem operations.

This Subsystem Specification is the second major product of the LCM Definition/Design Phase. The first product is the previously-published Referral Directory Functional Description (Reference 1.2.m). This Functional Description served as the basis for the functional requirements that are translated into specific input and output formats and processing steps in this document. The Subsystem Specification describes in detail how the system requirements, as stated in the Functional Description, will be met. The Subsystem Specification will serve as the primary means for reviewing the design of the system with the DTIC personnel and prototype participants. The Subsystem Specification will be updated as necessary to reflect any changes to the Referral Directory Subsystem.

This Subsystem Specification is organized into four major sections as follows.

Section 1, General, provides basic information relating to the Referral Directory Subsystem, such as its purpose and use.

Section 2, Summary of Requirements, provides a compendium of the Referral Directory Subsystem functional requirements.

Section 3, Environment, includes a detailed discussion of the equipment and system support software relevant to the Referral Directory Subsystem. The operating and user environments are also discussed.

Section 4, Design Details, provides specifications of the Referral Directory Subsystem functional design, including suggested operating procedures, the system logical flow, and a description of system data (input and output).

1.2   Project References

The general nature of the programs to be developed is information retrieval, database management, and information resources management. The purpose of the system is to provide DTIC users access to information about DoD specialized libraries, repositories, laboratories, testing facilities, information centers, and research facilities.

Development of the proposed Referral Directory Subsystem will be a cooperative effort involving a number of DTIC offices. The purpose of this paragraph is to list the references applicable to the history and development of the Referral Directory.

Project Title:	Directory of Resources
Project Subsystems:	Referral Directory
Project Sponsor:	Defense Technical Information Center, Office of Information Systems and Technology
Project Officer:	Carol Jacobson
Project User:	DGIS subscribers
Operating Center:	Defense Technical Information Center

Relevant references include:

a.   Abstracting and Indexing Guidelines. DTIC. January 1989.

b.   Defense Technical Information Center Cataloging Guidelines. DTIC. DTIC/TR-89/10. AD-A211 000. July 1989.

c.   Defense Technical Information Center Referral Data Bank Directory, 9th Ed. DTIC. AD-A138400. February 1984.

d.   Directory of DoD-Sponsored R&D Databases. DTIC. AD-B116 400. February 1988.

e.   Directory of Resources Online Retrieval System: User's Manual. CDC. June 1989.

f.   Directory of Resources Online Retrieval System: Program Maintenance Manual. CDC. June 1989.

g.   Document Data Worksheet, DTIC. DTIC Form 41. March 1980.

h.   DoD Gateway Information System (DGIS) Directory of Resources Project Implementation Plan. DTIC/CDC. December 1988.

i.   DoD Gateway Information System (DGIS) Directory of Resources Project Implementation Plan. DTIC/CDC. June 1989.

j.   DTIC Retrieval and Indexing Terminology, 3rd Ed. DTIC. January 1987.

k.   DTIC-DDR Letter, dated 13 July 1984, subject: DTIC Referral Data Bank Directory.

l.   Date, C. J., An introduction to database systems, Volume I, Fourth Edition, Addison-Wesley, 1987.

m.   Referral Data Bank, Referral Input, Standard Operating Procedures. DTIC. 10 September 1984.

n.   Referral Data Bank, Referral Output, Standard Operating Procedures. DTIC. 18 July 1984.

o.   Referral Data Worksheet, DTIC. DTIC Form 91. October 1985.

p.   Referral Directory Functional Description, DTIC/CDC. 18 September 1989, DTIC/TR-89/17, AD-A215 000.

1.3   Terms and Abbreviations

Term	Definition
Accession number	The AD number is composed of a transaction type prefix and a uniquely assigned serial number for ADP and document processing and control
AD	Accession Document
ADP	Automated Data Processing
ARPA.iet	Nationwide network developed and maintained by the Advanced Research Projects Agency
ASCII	American Standard Code for Information Interchange; a computer coding system used to represent the alphabetic, numerical, and punctuation characters
AUTOVON	Automatic Voice Network; dedicated phone system for Department of Defense
bpi	Linear bytes per inch; standard unit for density of encoding 9-track magnetic tapes for interchanging machine-readable data; three common standards are 800 bpi, 1600 bpi, and 6250 bpi.
C	A programming language; will be compliant with the standard defined by Kernighan and Ritchie (1978) or higher
DDN	Defense Data Network
DGIS	DoD Gateway Information System
dpi	dots per inch; standard unit for expressing print quality; based on linear resolution of ink or toner on paper; implies equal horizontal and vertical equal resolution, thus 300 dpi provides two dimensional resolving power of 90,000 dots per square inch
DRIT	DTIC Retrieval and Indexing Terminology; technical thesaurus providing controlled vocabulary for indexing subject material of interest to the DoD community

Term	Definition
DROLS	Defense RDT&E Online System
DTIC	Defense Technical Information Center
DTIC-BLD	DTIC Network Services Branch
DTIC-EA	DTIC Information Research and Technology Division
DTIC-FDRA	DTIC Reference Services Section
DTIC-FDR	DTIC Reference Services Branch
DTIC-H	DTIC Directorate of Database Services
DTIC-HAR	DTIC Retrieval Analysis Branch
DTIC-HD	DTIC Database Management Division
DTIC-HDB	DTIC Bibliographic Database Branch
DTIC-HDS	DTIC Database Support Branch
DTIC-Z	DTIC Directorate of Telecommunications and Information Systems
FAX	Facsimile transmission machine; system for sending facsimile copies of documents to remote printers; digitizes page images, transmits via modem over ordinary voice grade phone lines. FAX number usually refers to the phone line connected to FAX equipment set up to receive the facsimile
FTS	Federal Telecommunications System
FIPS	Federal Information Processing Standard; standard for ADP equipment, software, and interconnection mechanisms procured by the federal government
GOSIP	Government Open Systems Interconnection Profile; proposed FIPS for sharing computer resources with and from a network of computers, based on the Open Systems Interconnect (OSI) model developed by the International Standards Institute (ISO)
IAC	Information Analysis Center
INGRES	A relational database management system supplied by Ingres Corporation
IRM	Information Resource Management
OS	Operating System
RDBMS	Relational Database Management System
RDT&E	Research, Development, Test and Evaluation
Referral	Any activity in the Referral Directory, typically an organization such as a library, information analysis center, or test center
Referral Data Bank	Listing of Referral activities; maintained by DTIC
Referral Data Bank Directory	Hardcopy directory of Referral activities; generated by DTIC from its listings; distributed by DTIC to users
Referral Directory	Online database of Referral activities; available for retrieval and display through DGIS
RTIS	Remote Terminal Input System
TCP/IP	Transmission Control Protocol/Internet Protocol; standard for reliable data transmission across networks to heterogeneous applications and operating systems

Term	Definition
termcap	Terminal capabilities database; file describing capabilities of different VDT devices and how to use them
TR	Technical Report
TRIS	Technical Report Input System, computer software maintained by DTIC to update the TR Database with new Technical Reports
VDT	Video Display Terminal, data terminal using Cathode Ray Tube (CRT) or LCD (Liquid Crystal Diode) technology to display characters or images, with unlimited refresh capabilities

2   SUMMARY OF REQUIREMENTS

This section provides a summary of the Referral Directory Subsystem characteristics and requirements. This section links the functional requirements stated in the Referral Directory Functional Description to the system design presented in this document.

2.1   Subsystem Description

DTIC's referral services have existed since the early 1960's. Services have included: compilation of the Referral Data Bank, publication of the Referral Data Bank Directory, and inclusion of Referral information in the Technical Reports (TR) Database. DTIC users may search the TR Database using DROLS, but retrieved Referral records are not displayable online. The Referral Directory on DGIS will provide online search and display of Referral records. It will also provide compatibility with the existing system, so that current functionality will be maintained.

Integration of the Referral Directory into the Directory of Resources will support the DGIS goal of coordinating information resources. At the completion of this phase, users will be able to search for either databases or activities relevant to their needs.

Users will be able to access the Referral Directory remotely through the Referral Directory Online Retrieval System. The Online Retrieval System will provide capabilities for searching and browsing Referral information, and displaying it at user terminals in a variety of formats providing different levels of detail. The system will provide an interactive, menu-based interface that users will be able to use without extensive training.

The interface will be consistent with the other subsystems of the Directory of Resources. User commands, screen formats, and menu hierarchies of the Referral Directory will be structured to follow the conventions of the Directory of Databases Online Retrieval System.

Users will continue to have access to Referral information via the TR Database on DROLS. The Referral Directory will support a tape generation procedure to update the TR Database. Users will also continue to have access to the hardcopy Referral Data Bank Directory. The Referral Directory will support a procedure to generate this document directly from the database.

The database will be accessible to DTIC Directorate of Database Services (DTIC-H) and DTIC Reference Services Branch (DTIC-FDR) for input/editing and review. The Referral Directory Input/Editing System will provide an online, interactive interface to the Referral Directory. Upaates to the Referral Directory will be applied immediately.

Thus the Referral Directory Subsystem will provide the following capabilities to users:

a.   Updated editions of the Referral Data Bank Directory.

b.   Search and retrieval of Referral records.

c.   Online display of Referral records.

d.   More timely information about Referral activities.

2.1.1   Referral Directory Subsystem Design

A summary of the design and implementation necessary to provide the required capabilities is presented in this subsection. A more detailed description appears in Section 4.

Existing Referral data will be provided in machine-readable form by DTIC-Z. The medium will be industry standard 9 track magnetic tape. Format will be ASCII character set, density 1600 or 6250 bytes per inch (bpi), and any parity. Data will be formatted to allow separation of Referrals into records and each record into TR fields. The tape will be manually loaded onto the DGIS computer (see section 3.1). Appropriate processing will be performed to extract the information and put it in a format convenient for manual editing and automatic loading into the Referral Directory database.

The Referral Directory database will be designed to achieve third normal form or better. The relational data model defines a series of normal forms, or sets of properties which are held by good database designs. Third normal form characterizes designs that ensure that application software will maintain one-to-one and one-to-many relationships in the database (Reference 1.2.1).

For specifics of known one-to-one and one-to-many relationships, see the Functional Description section 2.4, Data Characteristics. One change will be made from the Functional Description: collection will *not* represent a one-to-many relationship. It will be treated as a one-to-one relationship: each Referral activity will have a single listing of its collection. It will be represented in a detail table to facilitate conformance to the design in the future. Apart from that, data will be represented in accordance with the specifications given in the Functional Description.

After the database has been designed and the data has been loaded, the database will be populated with integrities, permissions, and screen forms appropriate for the application. Integrities will conform to those specified in the Functional Description. Permissions will allow retrieval access to developers, managers, and specified users, and input, edit, delete, and update access to developers and DTIC-H staff. Forms defining appearance of screens in the Online Retrieval system will conform to those shown in sections 2.2.2 - 2.2.2.10.

The Online Retrieval System will then be developed. Software tools to be used will include query languages, forms editors, source control systems, embedded query languages, the C programming language (implemented at the standard of Kernighan and Ritchie, 1978), lexical analyzers, parser generators, and report specification languages.

The Online Retrieval System user interface will resemble that developed for the Online Retrieval System of the Directory of Databases (Reference 1.2.e). The flow of control is specified in Appendix A. Fast full-text searching will be implemented as in the Directory of Databases (Reference 1.2.f).

The capability of generating the hardcopy Referral Data Bank Directory will be implemented concurrently with the Online Retrieval System. Samples showing page layout and composition are given in Appendix B. Output quality will meet the standards established by the Directory of Databases: 300 dpi resolution, variable spacing, standard serif fonts, word wrapping, and avoidance of widows and orphans. Technology of

electronic publishing will be used: text processing tools, document markup languages, and laser printers.

An initial data call by DTIC Information Research and Technology Division (DTIC-EA) will provide an updated set of Referral information. Concurrently, the Referral Directory Input/Editing System and Tape Generation System will be developed. The Input/Editing System will provide interactive access to delete and modify existing Referrals and add new ones. The Tape Generation System will generate tapes for TRIS input to incorporate the changes to the TR Database.

After development and testing, access to the Referral Directory will be incorporated in the DGIS menus for general access. Users will utilize ordinary ASCII terminals or microcomputers with terminal emulation capability to connect to DGIS. An asynchronous modem operating at 300, 1200, or 2400 baud will be required to connect over phone lines. DGIS will also be available through TYMNET, DDN, a TCP/IP based local area network, and terminal server connections.

2.1.2   Availability of current services

The Referral Directory will support all current services. DROLS users will continue to be able to search the TR Database and the Current File. Retrieved Referral citations will not be available for online display. TR Database and Current File users will be able to display these records offline by requesting a print of the search results. Referral records will also appear in demand bibliographies when requested by the user. Users of the hardcopy Referral Data Bank Directory will continue to receive copies of each new edition. In addition, remote access to the Referral Directory will be enhanced with the Online Retrieval System.

To maintain currency of the TR Database, tape generation will be supported on an automated basis. The procedure may be initiated at any time by DTIC-Z for inclusion in the Current File. A 2-week scheduled tape generation may be implemented for correspondence with the TRAC cycle. Tapes will be transferred from the DGIS computer to the UNISYS 1100/82. They will be loaded as Remote Terminal Input System (RTIS) files. They will then be available for TRIS validation and update to the Current File and the TR Database.

2.1.3   User Site Software

Users will not require any special software to use the Referral Directory.

GUSTO staff will provide information on microcomputer communication software for correct emulation of standard ASCII asynchronous VDT hardware.

It should also be noted that the Online Retrieval System will be designed to optimize throughput at phone line speeds by redrawing only the parts of the screen that change. This makes the interface execute faster on remote displays. It is not intended to support screen capture. Downloading of displayed Referral citations is not a feature of the Referral Directory.

2.1.4   Organizational Impacts

The chart in Appendix F lists the organizations participating in Referral Directory development.

2.2   Subsystem Functions

The following paragraphs describe the functional components of the Referral Directory Subsystem in detail. The proposed Referral Directory Subsystem has five major functional components:

1. The database, containing all Referral citations.

2. The Online Retrieval System, providing an interface for end users.

3. The Input/Editing System, providing an interface for DTIC staff.

4. The tape generation procedure, to maintain the currency of Referral citations in the TR Database.

5. Generation of the hardcopy Referral Data Bank Directory.

2.2.1   Database Design

The database will be specified as follows. Each grouping below shows a table and its columns (fields). The key for each table is indicated by a • symbol.

REFERRAL		
• **refnum**	Integer	4
activity	Text	120
addr_line1	Text	60
addr_line2	Text	60
addr_line3	Text	60
addr_line4	Text	60
phone	Character	40
autovon	Character	40
fts	Character	25
fax	Character	20
lastmod	Date	
orgtype	Text	45
orgfunction	Text	30
contract	Text	22
coverage	Text	30
access	Text	400
hours	Text	100
annot	Text	820

LANGUAGE		
• **refnum**	Integer	4
lang	Character	20

POC		
• **refnum**	Integer	4
primary	Character	1
name	Text	40
title	Text	40

COLLECTION		
• **refnum**	Integer	4
item	Text	700

SERVICES		
• **refnum**	Integer	4
service	Text	50

PUBLICATIONS		
• **refnum**	Integer	4
pub	Text	530

DESCRIPTOR		
• **refnum**	Integer	4
weight	Character	1
term	Text	50

2.2.2   The Online Retrieval System

The Online Retrieval system will provide three types of searching and three corresponding types of browsing capabilities: by activity name, point of contact, and subject. Search capabilities will allow fast, flexible access to Referral citations. The corresponding browse capabilities will allow the user to learn what activity names, points of contact, and subject terms are available.

Whether searching or browsing is used, Referrals will be displayable directly at the user's terminal. Three display formats will be supported (Section 2.2.2.7 - 2.2.2.9), allowing the user to tailor information displayed on the retrieved Referrals. A complementary select function will allow the user to narrow the set of Referrals from a previous search or browse.

Search capabilities will support Boolean conjunction (AND-ing) and disjunction (OR-ing) of queries. Searches may be refined by adding, removing, or modifying search terms.

For instance, a query for "weather" may be made more restrictive by AND-ing the term "weather" with "navy", resulting in fewer retrieved Referrals. This may be expressed in a flexible manner: "navy and weather", "navy weather", and "weather and navy" are all correct and equivalent. A query for "weather" may be made less restrictive by OR-ing the term "weather" with "climate", resulting in more retrieved Referrals. This may be also expressed in a flexible manner: "navy or climate" and "climate or navy" are both correct and equivalent.

Implicit AND will be performed. For instance, "navy weather" will result in the same retrieved citations as "navy and weather" or "weather navy".

Queries with both AND and OR will be interpreted as grouping the AND first, i.e., AND will have higher precedence than OR. For instance, "air force or navy" will match those Referrals matching "air" and also matching "force", or else matching only "navy". Parentheses may be used to override this precedence. For example, "navy (weather or climate)" will match those Referrals matching "navy" and also either "weather" or "climate".

Queries will be supported up to arbitrary length, complexity, and grouping. For instance, "(air force or navy) technical services" is a valid query. The number of ANDs and ORs in a query is in principle unlimited. Current implementation tools limit the number of ANDs to 9 or fewer. For instance "army technical computer ballistic database interface testing services repositories" is permissible, but "army technical computer ballistic database interface testing services repositories analysis" is not supported by current implementation tools.

A list of stop words will be used to filter out "noise" words. The list is currently:

> a, an, and, are, as, at, be, been, by, for, from, has, have, in, is, it,
> not, of, on, or, that, the, these, to, which.

Stop words are not searchable. If the user includes a stop word in the query, a warning message will be presented and the stop word will be ignored. If all terms in a query are stop words, the query will not be performed. If one or more but not all of the terms in a query are stop words, the stop words will not be significant. A warning

message will be presented and the query will proceed as if only the other terms had been entered.

Browse capabilities will support three levels of motion for scrolling the display. A single line up or down will be provided simply by moving the cursor above or below the Referrals displayed. A screen sized scroll up or down will be performed when the user enters an appropriate key. The ability to go to a specific activity name, point of contact, or subject word will be available in response to choosing a "Goto" menu item. The "Goto" will be automatically right truncating; that is, entering a "Q" will go to the first entry beginning with Q.

Display formats will present a consistent interface, varying only in the level of detail displayed. The Referral Number of each Referral will be provided on each screen form, as well as its position within the current search or browse set, e.g. "3 of 7 Activities." The user will be able to change his mind at any time within a display, to choose a different display format, to go back to refine a query, or choose a different search or browse altogether. The user will be able to show each Referral in turn through appropriate menu items. The user will also be able to return to a previously displayed Referral without having to resubmit the query or browse.

After each search or browse, a count of how many Referral records matched will be displayed. This will provide a check on the effect of modifying the query. The user will be able to choose to proceed to display the Referrals, or to return to the search or browse to further refine the query. If the user proceeds to display the Referrals, a reminder of how many Referrals matched the query will be provided as the user proceeds.

Two exceptions to this normal flow of control are defined: the "zero hits" and "exactly 1 hit" conditions. If the search matches no Referrals, the user can not proceed to the online display. The interface will continue to provide another opportunity to refine the search, search on a different field, or browse. If the search or browse matches exactly 1 Referral, the Online Retrieval System will automatically proceed directly to the full detail display. This will support faster access to information by skipping over menus concerning choice of formats when not relevant.

The ability to return to the previous screen will be provided from every screen. The menu item to return to the previous screen will always be "Back" and it will always appear at the bottom of the screen. Online context-sensitive help will be provided from every screen. The menu item to get help will always be "Help". It will always appear at the bottom of the screen, just to the right of "Back". The ability to quit directly from any screen will be supported. The menu item to quit will always be "Quit". It will always appear at the bottom of the screen, just to the right of "Help".

The user interface will allow abbreviation and case insensitivity when selecting menu items. Any abbreviation up to ambiguity will be permitted. Menu item names will be chosen whenever possible to be distinct within the first character. Thus the user will be able to select "Help" and "Quit" by entering "H" and "Q" respectively, or "h" and "q", or "he" and "qu", and so on.

The user interface will support different terminal types. Any ASCII asynchronous VDT's for which a termcap (terminal capabilities) entry may be written will be supported. A partial list includes:

DEC VT100, DEC VT241, DEC VT240, Adm3a, Visual 300, Visual 241, Televideo950, Tektronics 4115, Hp 2621, Hp 150 Emulating An Hp2621, Concept 100, Microterm Mime1, Heathkit H19, Adds Regent 100, General Terminal 100a, Infoton 400, Addrinfo, Infotonkas, Microterm Act Iv Perkin Elmer 1100, Perkin Elmer 1200, Teleray 3800 Series, Teleray 1061, Adds Viewpoint, Wyse50, Raster Tech, Cit414a, Cit467, Hds200, Convergent Technologies Pt, Apollo 15 Inch Display

Those terminals, or microcomputer software emulating one of those terminals, may define function keys. If so, they will also be supported by the user interface where defined.

Another common feature to the user interface will be the title bar. It will be a reverse video line, enclosed inside a box, located at the top of the screen. It will display the name of the menu currently being displayed. It will indicate the current status of the Online Retrieval System: "Working...", "Searching...", or "Fetching..." when the user is waiting for the system, "Ready" when the system is waiting for the user. When searching or browsing is being performed, the title bar will display the number of hits from the last search or browse. When browsing or selecting is active, it will display the number of items tagged. When retrieved Referrals are being displayed at the user's terminal, it will indicate how many Referrals are ready to display. For this a "n of n total" style will be employed, e.g. "5 of 14 Referrals".

The top level menu will look like this:

```
+----------------------------------------------------------------------+
| Referral Directory (v1.2)                         Main Menu: Ready |
+----------------------------------------------------------------------+
 Welcome to the DGIS Referral Directory!

 What do you want to do?

                OPTION            DESCRIPTION

                Activity          Search by Referral Activity Name

                Subject           Search by Subject

                Person            Search by Point of Contact

                Browse            Browse the Referral Directory Indices

      Activity  Subject  Person  Browse  Help  Quit
```

2.2.2.1   Referral Name Search

The search by Referral Activity Name menu will look like this:

```
+---------------------------------------------------------------------+
| Referral Directory (v1.2)              Search by Activity Name: Ready |
+---------------------------------------------------------------------+


  Enter your query here:


  _____

Enter <RETURN> to start the search


Back   Help   Quit
```

A Referral Name query will initiate a search on the full text of the Referral activity name. It will provide case, punctuation, and order insensitive searching on all words in the activity name field. For instance, a search for "Missile" would match an activity named "White Sands Missile Range". Similarly, a search for "missile range" would match this activity, and also refine the search to remove Referrals that did not match "range". A search for "WHITE SANDS RANGE" would match this same activity, and also refine the search to only match Referrals whose name contained all three words.

As the user enters terms, they will appear on the screen like this:

```
+---------------------------------------------------------------------+
| Referral Directory (v1.2)              Search by Activity Name: Ready |
+---------------------------------------------------------------------+


  Enter your query here:

white sands

  _____

Enter <RETURN> to start the search


Back   Help   Quit
```

2.2.2.2   Subject Search

The search by subject menu will look like this:

```
+-------------------------------------------------------------------+
| Referral Directory (v1.2)              Search by Subject: Ready |
+-------------------------------------------------------------------+


 Enter your query here:


_____

Enter <RETURN> to start the search


Back   Help   Quit
```

A Subject query will initiate a search on the full text of the Annotation and the Descriptor fields. It will provide case, punctuation, and order insensitive search on all words found anywhere within the Annotation and Descriptor fields. For instance, the annotation for the White Sands Missile Range includes the text "tests guided missile systems for the Army, Navy, Air Force, and other government agencies and contractors." The descriptors include Guided Missiles, Test Facilities, and Reliability (Electronics). This citation would match a subject search for the following terms: missile, missiles, test, tests, reliability, electronics, army, navy.

2.2.2.3   Point of Contact Search

The point of contact search menu will look like this:

```
+-------------------------------------------------------------------+
| Referral Directory (v1.2)        Search by Point of Contact: Ready |
+-------------------------------------------------------------------+


 Enter your query here:


_____

Enter <RETURN> to start the search


Back   Help   Quit
```

A Point of Contact query will initiate a case insensitive search by the name of the point of contact. For instance, if a contact name is "Jonathan Swift, MD", a search for "Swift" or "SWIFT" would find the corresponding Referral activity. A search for "Jonathan Swift" would find the same activity, and match fewer other activities.

Searching is an effective strategy for the user who has some idea of the fields on which the search is being performed. To help the user who is not familiar with Referral data, and to provide another user interface, a general browse capability will be

implemented.

The browse menu will look like this:

```
+-------------------------------------------------------------------+
| Referral Directory (v1.2)                          Browse: Ready |
+-------------------------------------------------------------------+
    What index would you like to browse?


            OPTION          DESCRIPTION

            Activity        Browse by Referral Activity name

            Subject         Browse by Subject

            Person          Browse by Points of Contact

   Activity  Subject  Person  Back  Help  Quit
```

2.2.2.4   Referral Name Browse

The Referral Name Browse menu will look like this:

```
+---------------------------------------------------------------------+
| Referral Directory (v1.2)                            Browse: Ready |
+---------------------------------------------------------------------+
+-+-----------------------------------------------------------------+
| |Activity Name                                                    |
|-+---------------------------------------------------------------+|
| |Air Force School of Aerospace Medicine, Strughold Aeromedical Library  |
| |Army Center for Tactical Computer Systems                       |
| |Army Large Caliber Weapons Systems Laboratory, Energetic Materials Divisi|
| |Army Medical Research Institute of Chemical Defense, Wood Technical Libra|
| |Army Research Institute for the Behavioral and Social Sciences, Technical|
| |Army Research Institute of Environmental Medicine               |
| |Army Research Office                                            |
| |Army Russian Institute, Library                                 |
| |Army Satellite Communications Agency                            |
| |Army Sergeants Major Academy, Library and Learning Resources Center  |
| |Army Signal Center, Conrad Technical Library                    |
| |Army Tank-Automotive Research and Development Center, Technical Informati|
| |Army Test and Evaluation Command, Technical Information Center  |
| |Army Training and Doctrine Command (TRADOC), Technical Library  |
+-+-----------------------------------------------------------------+
   Tag(CTRL-T)  Untag  ClearTags  Goto  Search  Back  Help  Quit
```

A Referral Name browse will display names of Referral Activities on the user's terminal, one name per line. The user will be able to scroll forward and backward through the list.

When the user sees a Referral of interest, the user will tag it by moving the cursor next to it and selecting the Tag menu item. Alternatively, the user may move the cursor to the Referral and enter <CTRL-T>. Either way, this selects the Referral for later

display exactly as if it had matched the search.

When the user tags the Referral, an asterisk appears next to it to show that it has been tagged. In addition, the title bar will indicate how many Referral activities are currently tagged. Since the user may continue to scroll through the list, this will provide a reliable display of how many activities have been tagged.

```
+---------------------------------------------------------------------+
| Referral Directory (v1.2)          Browse Activities: 2 activities tagged |
+---------------------------------------------------------------------+
+-+-------------------------------------------------------------------+
| |Activity Name                                                      |
|-+-----------------------------------------------------------------+|
| |Air Force School of Aerospace Medicine, Strughold Aeromedical Library  |
| |Army Center for Tactical Computer Systems                         |
| |Army Large Caliber Weapons Systems Laboratory, Energetic Materials Divisi|
| |Army Medical Research Institute of Chemical Defense, Wood Technical Libra|
| |Army Research Institute for the Behavioral and Social Sciences, Technical|
| |Army Research Institute of Environmental Medicine                 |
| |Army Research Office                                             |
| |Army Russian Institute, Library                                 |
|*|Army Satellite Communications Agency                             |
| |Army Sergeants Major Academy, Library and Learning Resources Center    |
| |Army Signal Center, Conrad Technical Library                     |
|*|Army Tank-Automotive Research and Development Center, Technical Informati|
| |Army Test and Evaluation Command, Technical Information Center    |
| |Army Training and Doctrine Command (TRADOC), Technical Library    |
+-+-----------------------------------------------------------------+
   Tag(CTRL-T)  Untag  ClearTags  Goto  Search  Back  Help  Quit
```

The user will then be able to display or select the Referrals just as after a search. The number of records displayed is exactly the number of records in the Referral Directory. Finite screen sizes typically display about 20 at a time. The Goto menu item will provide faster access to activities than repeated scrolling. However, scrolling is not regarded as an impediment to browsing; the user may choose to gradually scroll through many screens of information in order to become more familiar with the Referral

Directory.

```
+-----------------------------------------------------------------------+
| Referral Directory (v1.2)           Browse Activities: 5 activities tagged |
+-----------------------------------------------------------------------+
+-+---------------------------------------------------------------------+
| |Activity Name                                                        |
|-+-------------------------------------------------------------------+|
| |Chemical Thermodynamics Data Center                                  |
|*|Civil Aeronautics Board, Library                                     |
| |Coastal Engineering Information Analysis Center (CEIAC)              |
| |Concrete Technology Information Analysis Center (CTIAC)             |
| |Corpus Christi Army Depot                                            |
| |Crystal Data Center                                                  |
| |Cutler Army Hospital, Medical Library                                |
| |Darnall Army Community Hospital, Medical Library                     |
|*|Data and Analysis Center for Software (DACS)                         |
| |David W. Taylor Naval Ship Research and Development Center, Propulsion an|
| |David W. Taylor Naval Ship Research and Development Center, Ship Material|
| |David W. Taylor Naval Ship Research and Development Center, Technical Inf|
|*|Defense Audiovisual Agency, Still Photographic Depository            |
| |Defense Audiovisual Agency, Tobyhanna Activity                       |
+-+-----------------------------------------------------------------+
    Tag(CTRL-T)  Untag  ClearTags  Goto  Search  Back  Help  Quit
```

As the user tags and scrolls, records already tagged will scroll off the display. A count of the number of tagged records is provided in the upper right corner of the screen. This will enable the user to determine the total number of tagged records as the browse proceeds.

2.2.2.5   Subject Browse

The Subject Browse menu will look like this:

```
+-----------------------------------------------------------------------+
| Referral Directory (v1.2)                              Browse Subjects |
+-----------------------------------------------------------------------+
     # indicates number of Referrals dealing with the same subject
+-+---+-----------------------------------------------------------------+
| | #| Subject keyword descriptor                                      |
|-+---+---------------------------------------------------------------+|
| | 15|weapon                                                          |
| |  2|weaponry                                                        |
| | 28|weapons                                                         |
| |  1|weapons/weapon                                                  |
| |  1|wear                                                            |
| | 11|weather                                                         |
| |  1|weightlessness                                                  |
| |  1|welding                                                         |
| |  2|welfare                                                         |
| |  3|well                                                            |
| |  4|western                                                         |
| |  1|whiskers                                                        |
| |  1|white                                                           |
+-+---+-----------------------------------------------------------------+
    Tag(CTRL-T)   Untag  ClearTags  Goto  Search  Back  Help  Quit
```

A Subject browse will display the words from the full text of the descriptors and the annotation. These are the "uniterm" words derived from every word in each complete DRIT term and the full text of the abstract. They will be displayed alphabetically, each next to the number of Referrals in the Directory that match that uniterm.

The user will be able to scroll forward arbitrarily through the list, but not backward. However, the Goto menu item may be used to resume the browse at any arbitrary point, including earlier in the list. The user will tag individual words via the menu interface. The user will then be able to display or select the Referrals just as after a search:

```
+------------------------------------------------------------------------+
| Referral Directory (v1.2)              Browse Subjects: 3 subjects tagged |
+------------------------------------------------------------------------+
     # indicates number of Referrals dealing with the same subject
+-+---+------------------------------------------------------------------+
| |  #|Subject keyword descriptor                                        |
|-+---+------------------------------------------------------------------+
|*| 15|weapon                                                            |
|*|  2|weaponry                                                          |
|*| 28|weapons                                                           |
| |  1|weapons/weapon                                                    |
| |  1|wear                                                              |
| | 11|weather                                                           |
| |  1|weightlessness                                                    |
| |  1|welding                                                           |
| |  2|welfare                                                           |
| |  3|well                                                              |
| |  4|western                                                           |
| |  1|whiskers                                                          |
| |  1|white                                                             |
+-+---+------------------------------------------------------------------+
   Tag(CTRL-T)  Untag  ClearTags  Goto  Search  Back  Help  Quit
```

The number of Referral activities that will match the browse can be inferred from the number shown next to each word on the screen. It cannot be stated exactly, since some activities match more than one word. It cannot be greater than the sum of the numbers next to each word, however, or less than the largest number of the selected terms. Therefore, a count of the number of tagged subject terms is displayed, not the

total number of matching Referrals.

2.2.2.6   Point of Contact Browse

The Point of Contact Browse menu will look like this:

```
+----------------------------------------------------------------------+
| Referral Directory (v1.2)              Browse by Point of Contact: Ready |
+----------------------------------------------------------------------+


+-+------------------------------+--------------------------------------+
| |Point of Contact              |Activity Name                         |
|-+------------------------------+--------------------------------------+|
| |Weinles, Carol                |Naval Sea Systems Command, Technical Libra|
| |Weiss, Egon                   |Military Academy Library              |
| |Weisz, John D.                |Human Engineering Laboratory          |
| |Wente, Van A.                 |National Aeronautics and Space Administrat|
| |Westbrook, Edwin              |Tactical Technology Center            |
| |Whalen, Thomas C.             |Water Resources Support Center, Port Facil|
| |White, O. L.                  |Marshall Space Flight Center Library  |
| |White, Richard M.             |Mossbauer Effect Data Center          |
| |Whitfield, Bradford L.        |Environmental Mutagen Information Center |
| |Whitfield, Bradford L.        |Environmental Teratology Information Cente|
| |Wildemuth, Barbara            |ERIC Clearinghouse on Tests, Measurement a|
| |Wilhoit, R. C.                |Texas Engineering Experiment Station, Ther|
| |Williams, Larry               |Tactical Technology Center            |
+-+------------------------------+--------------------------------------+
   Tag(CTRL-T)  Untag  ClearTags  Goto  Search  Back  Help  Quit
```

A Point of Contact browse will display the names of the points of contact and
their corresponding Referral activity. Each name will be displayed alphabetically next to
the name of the corresponding activity. The user will be able to scroll forward and
backward through the list. The user will tag names via the menu interface. The user will
then be able to display or select the Referrals just as after a search.

```
+----------------------------------------------------------------------+
| Referral Directory (v1.2)    Browse by Point of Contact: 2 persons tagged |
+----------------------------------------------------------------------+


+-+------------------------------+--------------------------------------+
| |Point of Contact              |Activity Name                         |
|-+------------------------------+--------------------------------------+|
| |Weinles, Carol                |Naval Sea Systems Command, Technical Libra|
| |Weiss, Egon                   |Military Academy Library              |
| |Weisz, John D.                |Human Engineering Laboratory          |
| |Wente, Van A.                 |National Aeronautics and Space Administrat|
| |Westbrook, Edwin              |Tactical Technology Center            |
| |Whalen, Thomas C.             |Water Resources Support Center, Port Facil|
| |White, O. L.                  |Marshall Space Flight Center Library  |
| |White, Richard M.             |Mossbauer Effect Data Center          |
|*|Whitfield, Bradford L.        |Environmental Mutagen Information Center |
|*|Whitfield, Bradford L.        |Environmental Teratology Information Cente|
| |Wildemuth, Barbara            |ERIC Clearinghouse on Tests, Measurement a|
| |Wilhoit, R. C.                |Texas Engineering Experiment Station, Ther|
| |Williams, Larry               |Tactical Technology Center            |
+-+------------------------------+--------------------------------------+
   Tag(CTRL-T)  Untag  ClearTags  Goto  Search  Back  Help  Quit
```

Since both the people and activity names will appear on the screen, the user can use either as a guide to selection. Since the Referral Name Browse provides browsing that focuses exclusively on activity names, the point of contact browse will not try to fit every activity name entirely on the screen.

As with subject browsing, the number of Referral activities that will match the browse can be inferred but not be stated exactly, since some points of contact serve for more than one activity. Therefore, a count of the number of tagged points of contact is displayed, not the total number of matching Referrals.

2.2.2.7   Short Display

The Short Display will look like this:

```
+-------------------------------------------------------------------+
| Referral Directory (v1.2)                      Short: 2 activities |
+-------------------------------------------------------------------+
+------+------------------------------------------------------------+
|Ref.No|Activity Name; Address; POC; Phone Numbers                  |
|------+-----------------------------------------------------------+|
|992020|Office of the Surgeon General (Army/Air Force), Medical Library; |
|      |Code AFML, Room 1B473, The Pentagon, Washington, DC 20310;  |
|      |Griffitts, Don K.; (202) 695-5752; AV: 695-5752             |
|992110|Air Force School of Aerospace Medicine, Strughold Aeromedical |
|      |Library, Code USAFSAM/TSK-4, Brooks AFB, TX 78235-5000; Goff, D. A |
|      |(512) 536-2254; AV: 123-2311; FAX: (512) 223-1231           |
|      |                                                            |
|      |                                                            |
|      |                                                            |
|      |                                                            |
+------+------------------------------------------------------------+
```

  Back   Help   Quit   :

The Short Display format will show the Referral Number, Referral activity name, a single Point of Contact name, and Phone Number(s): commercial, FTS, AUTOVON, and FAX. This is intended to support the quickest path between user and activity. It is meant for review purposes -- in some cases, to determine whether to view the complete record. Multiple Referral Activities will appear on a single screen. If there are too many to fit on one screen, as many as can be formatted on the space available will

be displayed initially, and then the display can be scrolled up and down.

2.2.2.8   Short with Annotation Display

The Short with Annotation Display will look like this:

```
+------------------------------------------------------------------------+
| Referral Directory (v1.2)               Annotation: 1 of 2 activities |
+------------------------------------------------------------------------+
Referral Number:    992020
Activity Name:      Office of the Surgeon General (Army/Air Force), Medical
                    Library
Address:            Code AFML, Room 1B473, The Pentagon, Washington, DC 203
                    10
Points of Contact:  Karlsruhe, F. J.

Phone Numbers:      Commercial: (202) 695-5752/5753    AUTOVON:
                    FTS:                                FAX:
Annotation:         The Office of the Surgeon General (Army, Air Force), Me
                    dical Library, specializes in hospital administration,
                    medicine, and military medicine.
   Next   Back   Help   Quit   :
```

The Short with Annotation display format will add the other points of contact, phone numbers (commercial, FTS, AUTOVON, and FAX), the descriptors, and annotation. Only one Referral activity will be displayed per screen. If descriptors and annotation do not fit in the space available, they will be scrolled up and down separately

from the rest of the display.

2.2.2.9   Full Display

The Full display menu will look like this:

```
+--------------------------------------------------------------------+
| Referral Directory (v1.2)          Full Detail Display: 1 of 2 activities |
+--------------------------------------------------------------------+
Referral Number:    992020                  Last updated: 01-sep-1983
Activity Name:      Office of the Surgeon General (Army/Air Force), Medical
                    Library

Address:            Code AFML, Room 1B473, The Pentagon, Washington, DC 203
                    10

Points of Contact:
Phone Numbers:      Commercial: (202) 695-5752        AUTOVON:
                    FTS:                               FAX:
Organization Function:  Medical Library
Organization Affiliation:      Army
Contract:
Coverage (Dates):
Access and Charges: Access is limited to DoD, other government agencie
                    s and educational institutions. Documents are prov
Hours of Operation:
Annotation:         The Office of the Surgeon General (Army, Air Force), Me
                    dical Library, specializes in hospital administration,
                    medicine, and military medicine.
Languages:
Services:
Collection:
Publications:


+--------------------------------------------------------------------+
|Descriptors                                                         |
|-------------------------------------------------------------------+|
|aerospace craft; *airframes; composite structures; computer graphics;  |
|*dynamic response; fatigue (mechanics); fracture (mechanics); history;  |
|stress testing; structural analysis; structural engineering; structures  |
|                                                                   |
|                                                                   |
+--------------------------------------------------------------------+
  Next   Back   Help   Quit
```

The Full display format will show the complete citation, all information listed
about the activity in the Referral Directory. The display will support scrolling forward to

display the whole record.

```
+---------------------------------------------------------------------+
| Referral Directory (v1.2)        Full Detail Display: 2 of 2 activities |
+---------------------------------------------------------------------+
Referral Number:    992110              Last updated: 01-nov-1984
Activity Name:      Air Force School of Aerospace Medicine, Strughold Aerom
                    edical Library

Address:            Code USAFSAM/TSK-4, Brooks AFB, TX 78235-5000


Points of Contact:
Phone Numbers:      Commercial: (202) 695-5752      AUTOVON:
                    FTS:                            FAX:
Organization Function:  Medical Library
Organization Affiliation:       Air Force
Contract:
Coverage (Dates):   All dates
Access and Charges: Access is limited to the scientific community. Req
                    uests from nongovernment activities for secondary
Hours of Operation:
Annotation:         The School of Aerospace Medicine provides postgraduate
                    education in clinical and aerospace medicine, preventiv
                    e medicine, technical education for Air Force mission o
                    bjective; RD programs in crew technical, flight and gro
                    und life support, aerospace medicine, human performance
                    , medical equipment, dental service operations, bioeffe
                    cts-radiation and chemical defense; medical evaluation
                    and consultation for flying personnel with difficult me
                    dical problems; safety research and engineering consult
                    ation concerning man-rated hyperbaric chambers in AFSC;
                     epidemiology services with clinical laboratory and ref
                    erral.
Languages:
Services:           reference, referral
Collection:
Publications:
+---------------------------------------------------------------------+
|Descriptors                                                          |
|---------------------------------------------------------------------+|
|aerospace craft; *airframes; composite structures; computer graphics;   |
|*dynamic response; fatigue (mechanics); fracture (mechanics); history;   |
|stress testing; structural analysis; structural engineering; structures  |
|                                                                      |
|                                                                      |
+---------------------------------------------------------------------+
   Previous  Back  Help  Quit  :
```

After the user has scrolled forward through the entire record, the display will place the cursor on the menu line to indicate that the next Referral citation is ready. The user can review this record or continue with the other records that matched the search or

browse.

2.2.2.10   Select

The Select menu will look like this:

```
+----------------------------------------------------------------------+
| Referral Directory (v1.2)                              Select: Ready |
+----------------------------------------------------------------------+
+-+------------------------------------------------------------------+
| |Referral Name; Organization                                       |
|-+-----------------------------------------------------------------+|
| |Defense Audiovisual Agency, Still Photographic Depository         |
| |Defense Technical Information Center, Manpower and Training Research Info|
| |Frank J. Seiler Research Laboratory                               |
| |Navy Acquisition, Research and Development Information Center      |
| |Office of the Surgeon General (Army/Air Force), Medical Library   |
| |Rome Air Development Center                                       |
| |Air Force School of Aerospace Medicine, Strughold Aeromedical Library |
| |Eastern Space and Missile Center                                 |
| |White Sands Missile Range, Technical Library                     |
| |                                                                 |
| |                                                                 |
| |                                                                 |
| |                                                                 |
| |                                                                 |
+-+----------------------------------------------------------------+
  Tag(CTRL-T)  Untag  ClearTags  Search  Back  Help  Quit
```

After a search or browse, the user may choose to review the Referral records that matched. The select capability displays a one-line description of each Referral, showing its name next to a "select column" displayed on the screen. The user may manually select individual Referrals from the list by moving the cursor next to the

Referral Name and entering a key.

```
+-----------------------------------------------------------------+
| Referral Directory (v1.2)                Select: 2 activities tagged |
+-----------------------------------------------------------------+


+-+-------------------------------------------------------------------+
| |Referral Name; Organization                                      |
|-+-----------------------------------------------------------------+|
| |Defense Audiovisual Agency, Still Photographic Depository         |
| |Defense Technical Information Center, Manpower and Training Research Info|
|*|Frank J. Seiler Research Laboratory                               |
| |Navy Acquisition, Research and Development Information Center      |
| |Office of the Surgeon General (Army/Air Force), Medical Library    |
|*|Rome Air Development Center                                        |
| |Air Force School of Aerospace Medicine, Strughold Aeromedical Library |
| |Eastern Space and Missile Center                                  |
| |White Sands Missile Range, Technical Library                      |
| |                                                                  |
| |                                                                  |
| |                                                                  |
| |                                                                  |
+-+-------------------------------------------------------------------+
   Tag(CTRL-T)  Untag  ClearTags  Search  Back  Help  Quit
```

This will provide a way to select a subset of a search that matched 10 to 50 Referrals. A search or browse resulting in fewer than 10 matches need not utilize this functionality. For searches or browses resulting in more than 50 matches, it would be more appropriate to refine the search through additional search terms.

2.2.3   The Input/Editing System

The Input/Editing System will implement three operations: adding new Referrals, updating existing Referrals, and deleting Referrals. These operations will be accessible separately from a common interface. The interface will be forms based and fully interactive. It will provide menus to guide the user through the process of entering and editing Referral citations. It will present screen displays and prompts appropriate to each step of the processes of inputing, editing, and deleting.

The user of the Input/Editing System will be DTIC-H. End users will not be given access to the Input/Editing System. End users will have access to the Online Retrieval System, as well as have access to the hardcopy Referral Data Bank Directory. DTIC internal users will have access to both the Input/Editing and the Online Retrieval System. This section discusses the Online Retrieval System from the point of view of the end user, however.

The interface will provide access to online data. When a new Referral is added to the Referral Directory via the Input/Editing System, it will be available immediately to users of the Online Retrieval System. Similarly, when an existing Referral is updated, the updates will be available immediately. When a Referral is deleted, it will immediately be removed from availability to users.

All data elements may be input or updated at any time. The Input/Editing System will validate all inputs according to the rules and integrities defined in the Functional Description. The Input/Editing System will not allow entry of a new Referral

without two required fields: referral number and referral activity name. It will also automatically set one field: date of last update. This will be set to the system date at the time a Referral is input or updated.

The Input/Editing System will provide a function to enable printing of an individual record for a Referral. This will provide hardcopy for proofreading after entry of new or updated Referrals. The user may in addition use the Online Input/Editing System to review new and existing records online at the user's terminal.

The Input/Editing System will be accessed from ordinary ASCII asynchronous VDT's. Its screen displays will require VDT's capable of cursor positioning. Any terminal for which a termcap (terminal capabilities) entry may be written is satisfactory.

2.2.3.1   Input

New Referrals will be input using forms-based data entry. The screen display will provide a form with fields for each data element. To add a new Referral, the user will fill out this form.

The user will enter values for a field by entering them on the screen next to the field name. The user will be able to move from field to field by entering <TAB>. The user will be able to move to previous fields by entering <CTRL-P>. These keys will allow the user to move to any field on the form. The form will be designed, however, to facilitate data entry by consecutive placement of fields on the screen.

One field will have a built-in validation: referral number must be a number. No alphabetic or punctuation characters will be allowed. The Input/Editing System will not permit the user to <TAB> to advance to the next field until a valid number has been entered.

The interface will allow the user to select a menu item at any time by entering the menu key, usually assigned to <ESCAPE>. The menu key moves the cursor from the form to the menu line at the bottom of the form. After the menu item has been selected, the cursor returns to the field where it was when the menu item was selected. This allows the user to select a menu item without losing context of inputs and updates to the form. If the user enters the menu key accidentally, the user may simply enter <RETURN>; this returns the cursor to the field where it was without selecting any menu item.

When the user has entered the data, the user selects the "Input" menu item. The Input/Editing System then validates all fields. If all fields are valid, the Referral is added immediately.

If one or more fields encounter validation checks, the Input/Editing System displays appropriate messages, then moves to the first invalid field. The user may then correct the values entered in this field. The user may also change other fields at this time. When the user has corrected the information, the user may select the "Input" menu item again. If all fields are now valid, the Referral is added immediately. Otherwise, the Input/Editing System continues with the next correction. It displays appropriate messages, then moves to the next invalid field.

One field will be treated specially by the Input/Editing System: date of last update. This field will be automatically set by the Input/Editing System to the system date at the time the Referral passes validations and is successfully input. Therefore, it

will not be displayed in the form and the user will not be given a means manually to input a date into this field.

2.2.3.2   Edit

The process of updating a Referral will consist of three parts: retrieving the existing Referral, making the changes, and validating and saving the changes.

The Referral may be retrieved by its Referral Number. The user will enter the Referral Number of the desired Referral into the designated screen field. The user will then select the "Retrieve" menu item. The Input/Editing System will then retrieve the Referral and display it on the screen. The resulting display will be presented exactly as if the user had just filled out the form. The interface to update any field will be the same as to enter a new field.

The user will enter <TAB> and <CTRL-P> to move to a field. The user may change the field by overstriking it. This is suitable for short entries such as AUTOVON number. Or the user may input characters and words into the current field, adding to any information currently in the field. The user will be able to toggle between overstrike and input modes by entering <CTRL-E>. The user may also delete characters in either mode. The user will be able to delete a character by entering <CTRL-D>. In this way long text strings such as annotation will be able to be input and edited.

After the user has changed a field, the user may then <TAB> to any other field to be changed. The user may continue to make changes by moving to the fields to be changed and editing them. The screen display will maintain an accurate representation of the modified data at all times. This will enable the user to review every field before saving changes.

After the user has changed one or more fields and is ready to save the changes, the user selects the "Save" menu item. The Input/Editing System will then validate all fields exactly as for a new Referral. If all fields are valid, the Referral will be updated immediately.

If one or more fields are invalid they will trigger validation checks. The Input/Editing System will then respond exactly as for validation failures when adding a new Referral. It will display appropriate messages, then move to the first invalid field, and wait for the user to make corrections. The user may then correct the values in this field, and may also change other fields. Again, <TAB> or <CTRL-P> will move to the field to be changed. The user will then be able to input, overstrike, and delete characters within that field.

When the user has entered all desired corrections, the user will then be able to again select the "Save" menu item. If all fields are now valid, the Referral will be updated immediately. Ot˙erwise, the Input/Editing System will continue with the next correction. It will display appropriate messages, move to the next invalid field, and wait for the user to make further corrections.

The Input/Editing System will treat one field differently on updates: the referral number. When the user first adds a new Referral, the Input/Editing System will allow the user to choose any number that has not already been assigned to another Referral. When the user is updating an existing Referral, the Input/Editing System will not allow the user to change the number once assigned.

As mentioned above, the Input/Editing System will not display the date of last update when entering a new Referral. When updating an existing referral, the field will be displayed but will not be modifiable. The display-only requirement will be reflected in the user interface: <TAB> and <CTRL-P> will skip over this field. The user will see the date that the Referral was last updated, but will not be allowed to set the date manually. The Input/Editing system will set the date to the system date at the time the Referral passes validations and is successfully updated.

2.2.3.3   Delete

The process of deleting a Referral will consist of two parts: specifying the Referral to be deleted, and confirming the delete.

The Referral will be specified by its referral number. The user will enter the referral number and then <RETURN>. The Input/Editing System will retrieve the referral name, address, and annotation. It will display these fields at the user's terminal. This will provide a visual check before proceeding with the delete. The Input/Editing System will then prompt the user to confirm the delete.

If the user reponds "yes" to this prompt, the Referral will then be deleted. Abbreviations will *not* be permitted here. The user must confirm the delete with the full "yes" or the delete will not be performed. If the user responds with any answer other than "yes" the delete will not be performed. Once the user has responded with "yes" and entered <RETURN>, the delete will be performed immediately, and will not be abortable.

2.2.4   Tape generation for input to TR

An automated process for generating tapes to update the Technical Reports Database (TR) will provide a means of keeping TR current. The tape format will conform to the requirements for batch updates to Remote Terminal Input System (RTIS) files.

Tape generation from the Referral Directory will be implemented as a standalone procedure, not connected to the Input/Editing System or Online Retrieval System. The DTIC-F user will initiate the procedure when needed. It is anticipated that during periods without data updates to the Referral Directory this will prevent the need for null updates to TR. Access to the procedure will be provided by a simple command available from the Input/Editing System or as a direct command to the standalone procedure.

The user will first mount a scratch tape on the Pyramid tape drive. The user will then simply request TR tape generation. The procedure will first determine which Referrals to write to the tape. It will proceed to write them to the tape and provide status updates at the user's terminal while doing so. The procedure will report any errors or exceptions at this time, since update to TR is required to be an automated process handled without further intervention from Directory software. When the procedure has completed writing the last Referral to the tape, it will rewind the tape and then report completion to the user. The user will then dismount the tape and give it to the DTIC-Z contact point for update to TR.

For information on how Referral information maps into TR Database fields, see Appendix E.

2.2.5   Generation of the hardcopy Referral Data Bank Directory.

The hardcopy Referral Data Bank Directory will be generated by a standalone procedure similar to that used for TR tape generation. Access to the procedure will be via an interactive command line interface similar to TR tape generation.

The procedure will first prompt the DTIC-F user to specify whether to produce the Referral Data Bank Directory or a listing of each Referral suitable for a data call. The user will specify which one to produce. Then the procedure will prompt the user to specify whether to list all or only selected Referrals. If the user specifies all Referrals, no further questions will be asked. The procedure will then generate the hardcopy and send it to the laser printer.

If the user specifies selected Referrals, the procedure will then prompt the user for the selections. The user will be able to enter the selections in a simple format like "890000-890500,891000" to list Referrals between 890000 and 890500 and also the individual Referral 891000. The procedure will then generate the hardcopy and send it to the laser printer.

The format and appearance of the generated hardcopy will approach typeset quality. A sample Referral is provided in Appendix B. The general layout conventions will resemble that used for the Directory of DoD-Sponsored R&D Databases (Reference 1.2.d).

Also similar to the Directory of DoD-Sponsored R&D Databases, the Referral Data Bank Directory will provide three indices: a subject index, an index to points of contact, and an index by Referral Activity name. Samples of all three are provided in Appendix D.

2.2.6   Accuracy and Validity

The same accuracy requirements utilized for the entry of Referral citations into the TR Database and for the production of the Defense Technical Information Center Referral Data Bank Directory will be applied to the Referral Directory and hard/microfiche copy Directory. These requirements are documented at length in the Defense Technical Information Center Cataloging Guidelines (Reference 1.2.b), the Referral Directory Functional Description (Reference 1.2.p), and in Section 3.4, Data Characteristics.

2.2.7   Timing

Response time for input of data, update of the database, and queries of the Directory will vary from a few seconds to a few minutes. Response time is also dependent on machine load. A response should appear within a few seconds under an expected average machine load. This performance is insensitive to number of records, field lengths, record lengths, and will not degrade sharply with incremental changes in the same.

2.3   Flexibility

The Online Retrieval system will provide a flexible development and production environment to accommodate changes. The procedures for adding, deleting, or modifying data elements will be straightforward.

It will be possible to add integrities and modify relationships between data elements. For example, the data element "Languages" is currently limited to one of

{Chinese, Dutch, French, German, Italian, Russian, Spanish, Japanese}. This is enforced through an integrity in the database limiting field contents to one of these valid langauges. This integrity can not be bypassed by using a different interface to the Directory, because it is defined on the database itself. If in the future it is desired to add other languages, the integrity may be modified to allow additional valid languages.

It will be easy to display fields in a variety of formats. It will be possible to customize screen displays and printed reports to suit changing needs.

3   ENVIRONMENT

The environment required to develop, maintain, and operate the Referral Directory includes equipment used by DTIC staff to input and edit Referrals, equipment used by end users to retrieve and display Referrals, and equipment used by the developing organization to implement the subsystems described in this document.

3.1   Equipment Environment

The following equipment is broken down by use and location. No overlap is implied: items of equipment specified for one use or in one location need not be replicated for another use or in another location.

3.1.1   Equipment where the database will reside

This equipment will include a Pyramid 98x configured with 32 megabytes of main memory, 2.2 gigabytes of disk storage, a Berkeley UNIX operating system called OSx 4.4, a laserprinter with PostScript capability, a line printer with tractor feed capability for printing mailing labels, a terminal and print network based on TCP/IP over local ethernet and remote T1 links, and standard ASCII asynchronous terminals.

3.1.2   Data Input/Entry/Delete Equipment

This equipment will include a standard ASCII asynchronous terminal, a communications link to the Pyramid providing data rates of 9600 baud or higher, and a local laserprinter with PostScript capability for printing individual records for proofreading.

3.1.3   User Equipment

This equipment will include a standard ASCII asynchronous terminal or microcomputer with terminal emulation capability, a communications link to the Pyramid providing data rates of 2400 baud or higher.

3.2   Support Software Environment

Procedural programming will be performed in C meeting the standard of Kernighan and Ritchie, (1978). Nonprocedural programming will be performed in QUEL (Stonebraker, 1979) or SQL (ANSI, 1986). Applications will be generated using RTI development tools ABF/OSL, EQUEL, ESQL, report writer, the VIFRED visual forms editor. Operating system services will be provided by Berkeley 4.2 BSD UNIX or above, with the intention of supporting POSIX as POSIX-compliant application environments become available.

Specific tools required on the Berkeley UNIX host will include a C compiler, ld, lex, yacc, awk, sed, make, RCS, termcap/curses, nroff/troff, the -ms (manuscript) formatting and typesetting macros, Adobe Transcript software to support PostScript laserprinters, and GNU Emacs. Specific tools supplied by Ingres may be enumerated as embedded query language (EQUEL), embedded structured query language (ESQL), the Applications-by-Forms fourth generation language and development shell (ABF), the forms runtime system, the Query-by-forms (QBF) canned query tool, the Visual Forms Editor (VIFRED), INGRES/Net with TCP/IP support, and the QUEL and SQL terminal monitors.

3.3   Interfaces

The Online Retrieval system will interface to the database through the QUEL or SQL query languages. Queries will be expressed in one of these languages and sent to the database. No direct access to online information will be permitted. Software will not be able directly to access disk files, or call database functions or procedures. All access will be limited and structured via the query language interface.

The user interface will be built with a forms system supplied by the database vendor. This will give the appearance and behavior of a terminal screen with active "fields" where user input will be accepted, and display-only fields where data from the database will be displayed.

3.4   Security

The Referral Directory is an unclassified system. It is not, however, open to the public. Access to the Online Retrieval system will be restricted to authorized users. Access restrictions will be maintained on three separate levels: DGIS permissions, INGRES permissions, and permissions to the Online Retrieval system.

3.5   Controls

The INGRES relational database management system (RDBMS) will provide an extensive set of controls. Device and data independence will be maintained by this software so that user software can be relied upon to produce identical results when running on different machines. This will make practical the development of software on a machine which may be different from the one where the software will be deployed. Data consistency and integrity will be assured through definitions of integrities governing all inputs and updates. INGRES allows the definition to be applied to the database itself, so that the integrity cannot be violated even if different interfaces are used to access the data.

In addition, INGRES provides three sets of tools for maintaining, checking, and restoring database consistency and integrity. The first set is comprised of rtingres, catalogdb, and the help commands in the terminal monitor. These provide different interfaces to essentially the same functionality: listing the database, examining the data dictionary, and verifying ownerships, permissions, integrities, and table and record sizes and definitions. The second set is comprised of auditdb, restoredb, and purgedb. These allow the database administrator to monitor access and usage, check for damage due to system crashes, and recover from most database inconsistencies. The third set is comprised of ckpdb, unloaddb, and recoverdb. These allow the database administrator to perform checkpoints and backups, and, if necessary, to recover the database to the last checkpoint.

4 DESIGN DETAILS

This section provides detailed information on how the system will be implemented. Sources, applications, and uses of data are identified. Mechanisms and procedures for developing and operating the system are listed.

4.1 General Operating Procedures

The system in operation receives all input and provides all output to online ASCII asynchronous terminals. Data is entered online, stored online, and updated online. A single consistent database is maintained at all times. Referral data is stored and retrieved via interactive programs that access the database and display information to ordinary ASCII terminals.

Referrals are ordinarily entered into this database via the Input/Editing System, but bulk loading of data is also possible. Either way, the database consists exactly of those Referrals currently stored in it. Users of the Online Retrieval System will be able to retrieve and display a Referral as soon as it has been entered. The hardcopy Referral Data Bank Directory is simply a report on the Referrals currently stored in the database.

The database in turn is stored on disk volumes. Database tables are implemented as disk files. The database resides in a well known place in the host filesystem. The host operating system executes the database management software and user software developed for the Referral Directory by creating and executing processes. The host provides process protection and separation, file permissions, and print and input/output services.

User software will be developed to facilitate input, editing, review, and output of Referral information. It will also be possible for specialists to access the database via general query tools and custom interfaces. These will not allow the user to bypass database permissions or subvert database integrity.

4.2 System Logical Flow

Referral data is entered into the Referral Directory by DTIC-H. The Input/Editing System is used to enter the data, validate it, and verify that it has been correctly entered online. The data is stored into a relational database. It is therefore the function of the Input/Editing System to provide a user interface appropriate for the Referral Directory to DTIC-H, and a system interface appropriate to a relational database management system to the host computer.

Once Referral data has been entered online, it is immediately available to end users via the Online Retrieval System. The Online Retrieval System may also be used by DTIC-H. However, end users can not use the Input/Editing System.

The Online Retrieval System and Input/Editing System are provide highly interactive interfaces to the Referral Directory. Hardcopy Generation and Tape Generation are designed to provide automated export of Referral data. They are initiated by separate, standalone procedures, and are intended to neither need nor want user input after they have been initiated.

The Relational Database Management System (RDBMS) is the central entity through which all other systems must go to access data. Only it can access data directly on disk. In this way it can maintain data security and integrity. This also provides a

degree of data abstraction and independence. It allows for future adding of fields or changing field sizes without interfering with existing programs and procedures. Finally, it guarantees consistency: a single definitive copy of the database is presented at all times.
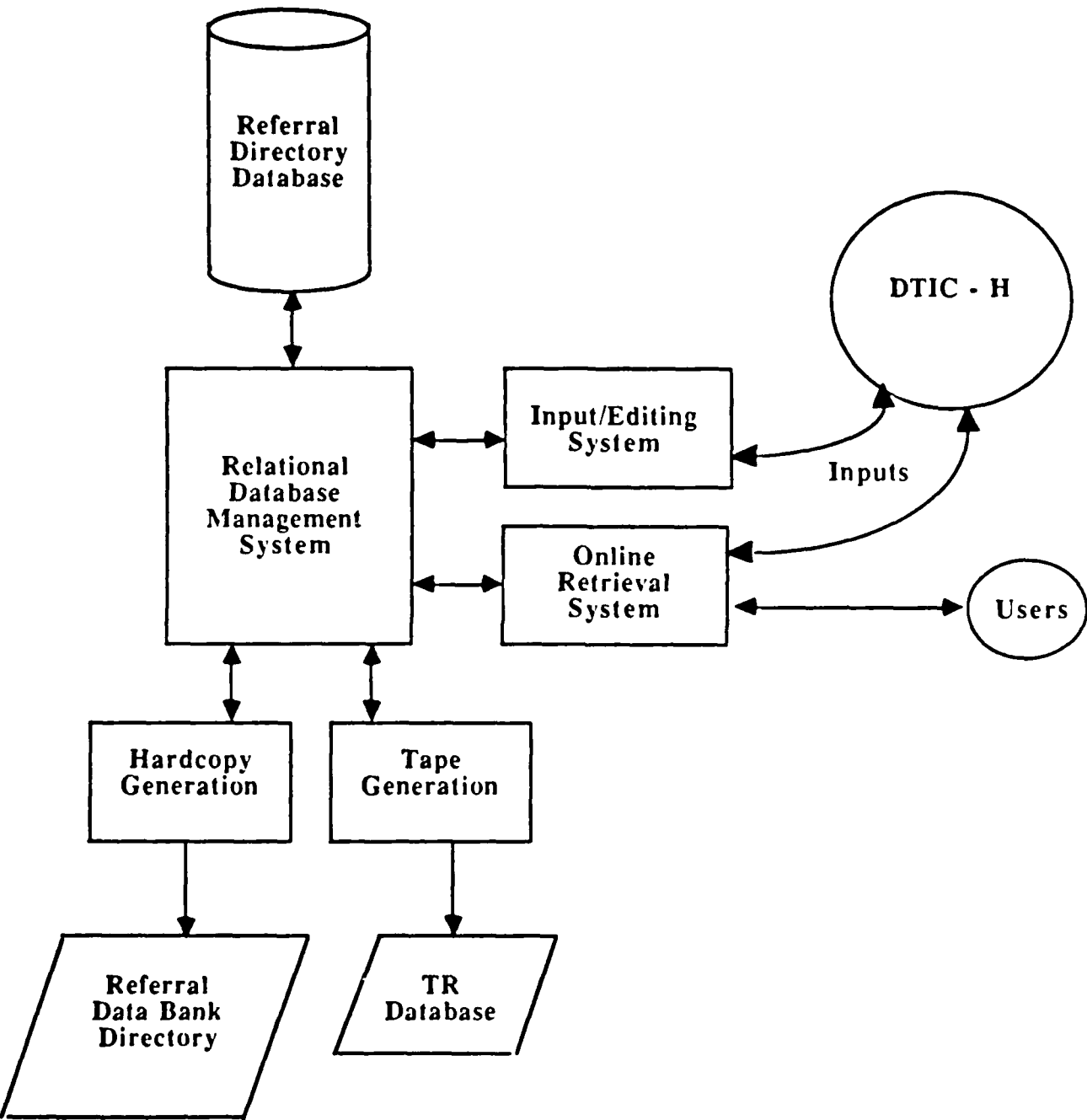
System Logical Flow

4.3   System Data

Any data element may be input via the Input/Editing System except the date of last update, which is set for each Referral to the system date at the time of its successful entry or update. Any data element may be output via the Online Retrieval System or generation of the hardcopy Referral Data Bank Directory or generation of TR tapes. All data will be accessible to multiple users concurrently. Ordinary users will not be permitted update access. Input, update, and deletion of Referrals will be permitted only to authorized DTIC users.

4.3.1   Inputs

Each data element may be described by name, type, function, validations, and, when applicable, relationships to other data elements:

Referral Number

> Integer: the primary key. Example: 991491. It uniquely identifies each Referral. This is a required field; the input system will not allow entry of a new Referral without a referral number. Permissible key values are positive integers of exactly six decimal digits. For TR input, the characters "AD" and optionally an additional letter will be prepended to form an AD number of total length 8 characters. Input of new Referrals into the Referral Directory will not require entry of the "AD", however, and it will not be stored in the Referral Directory database. Validations: must be a unique number (not already assigned to another Referral) of 990000 or greater.

Activity Name

> Text: The name of the Referral activity. Example: US Geological Survey, Library. Can be up to 120 alphanumeric characters, but for TR input, length cannot exceed 116 characters. (For more information on how Referral information maps into TR Database fields, see Appendix E). This is a required field: the input system will not allow entry of a new Referral without an activity name. Validations: none, although the possibility of using the Corporate Source Header List, keyed through the source code, as a name authority file should be considered.

Address

> Text: The address of the Referral activity. Example: National Center, MS950, 12201 Sunrise Valley Drive, Reston, VA 22092. Can be up to 4 address lines, each up to 60 alphanumeric characters. This may be expanded, but for TR input, total length including phone numbers cannot exceed 450 alphabetic characters. Validations: none.

Commercial Telephone Number

> Text: The commercial telephone number of the Referral activity. Example: (703) 860-6671. Can be up to 40 alphanumeric characters. Includes area code, telephone number and extension. Will be input, stored, and output exactly as shown. Validations: none.

AUTOVON Number

> Text: The AUTOVON number of the Referral activity. Example: 473-7063. Can be up to 40 alphanumeric characters. Will be input, stored, and output exactly as shown. Validations: must be of form nnn-nnnn where n is a decimal digit.

FTS Number

> Text: The FTS number of the Referral activity. Example: 928-6671. Can be up to 25 alphanumeric characters. Will be input, stored, and output exactly as shown. Validations: none.

FAX Number

> Text: The telephone number of a FAX machine at the Referral activity. Example: 703-998-2700. Can be up to 20 alphanumeric characters. Includes area code and telephone number. Will be input, stored, and output exactly as shown. Validations: none.

Points of Contact

> Text: Names and titles of persons who are points of contact for the Referral activity. Example: Chappell, B. A., Chief, Reference; Messick, C. H., Reference Librarian. Names can be up to 40 alphabetic characters, titles can be up to another 40 characters. These lengths may be increased, but for TR input total length for each point of contact cannot exceed 120 characters. This is a detail table: this means that each Referral activity can list zero, one or many points of contact. However, for TR input, total length of all points of contact cannot exceed 620 alphabetic characters. In the data call, sources will not be solicited for more than 2 points of contact. A change from the design specified in the functional description is that one point of contact will be designated the primary point of contact. This will mark the point of contact to be named on the "attention to" designations on mailing labels, such as will be used for the data call. Validations: none.

Date of Last Update

> Date: The date that the Referral activity was last updated. Example: 850501. Will be set automatically to the date of inputting or editing the Referral. For TR input, will be formatted YYMMDD as shown. For output to Referral Data Bank Directory, will be formatted for ease of reading; for example, "May 1, 1985". Validations: limited to legal dates after 1 Jan 90.

Languages

> Text: Languages the Referral activity supports in some way, such as collection or translation services. Example: German; Chinese. Each language can be up to 20 alphabetic characters. This is a detail table: each Referral activity can list zero, one or many languages. For TR input, total length cannot exceed 140 alphabetic characters. Only languages other than English are listed. Validations: valid languages are Chinese, Dutch, French, German, Italian, Russian, Spanish, Japanese. Other valid languages may be defined later.

Organization Function

> Text: The function of this Referral activity. Example: Technical Library. Can be up to 30 alphabetic characters. This may be expanded, but for TR input, the length cannot exceed 35 characters. Validations: valid types are Academic Library, IAC, Library, Medical Library, Research Laboratory, Technical Library. Other valid types may be defined later.

Organization Affiliation

> Text: The branch of service with which this Referral activity is affiliated. Example: Department of the Interior. Can be up to 45 alphabetic characters in length. This

may be expanded, but for TR input, the length cannot exceed 35 characters. Validations: valid functions are Army, Navy, Air Force and DoD. Other valid functions may be defined later.

Collection

Integer and Text: The collection of resources available at this Referral activity. Example: 750,000 books, 340,000 microforms, 310,000 maps, and 270,000 pamphlets. Department of the Interior. Can be up to 30 alphanumeric characters for each type, up to 4 billion (4,000,000,000) to indicate how many of that type. This is a detail table: each Referral activity may list zero, one, or many collection types. For TR input, however, total length cannot exceed 600 characters. A variance from this design is currently being used, however, which allows representation of the collection as a one-to-one relationship. The entire listing is limited to 700 characters. Validations: valid resources are books, classified materials, computer software, government reports, journals/serials/periodicals, maps, microforms, online systems, (BRS, DIALOG, DROLS, MEDLARS, ORBIT or others), phonograph records or audio tapes, photographs, scientific and technical data sets, technical reports, translations, unpublished materials and video cassettes. Other valid types may be defined later.

Descriptors

Text: Subject descriptors giving subjects for this Referral activity. Example: *Geology, *Mineralogy, *Topography, *Geochemistry, *Geophysics, *Paleontology, *Ground Water, *Surface Waters, *Minerals, *Hydrology, *Maps, *Mapping, *Petrography, *Photographs, *Earth Sciences, *Photography, *Water Resources, *Charts, Geodetic Surveys, Floods, Geological Survey. Can be up to 50 alphanumeric characters. Key words that describe material this organization will have, taken from the DRIT (Reference 1.b.j). This is a detail table: each Referral activity can have an unlimited number of descriptors. However, for TR input, total length cannot exceed 1200 characters. Some descriptors are weighted; each Referral activity can have an unlimited number of weighted descriptors. Validations: each Referral activity must have at least one weighted descriptor; each descriptor must be taken from the DRIT.

Services

Text: The types of services this Referral activity offers. Example: Referral, Reference, Loans (Interlibrary), Cartography. Can be up to 50 alphanumeric characters for each type. This is a detail table: each Referral activity may list zero, one or many services. However, for TR input, total length cannot exceed 1200 characters. Validations: valid services are bibliography compilation, consultant, data compilation, identification, literature searches, interlibrary loans, manual searches, online searches, reference Referral, state-of-the-art reviews, technical analysis and evaluation, and technical answers. Other valid types may be defined later.

Publications

Text: The specific names of printed journals, papers, reports, newsletters or other types of items published by this Referral activity. Example: Scintillation Spectrometry, Gamma-Ray Spectrum Catalogue, State-of-the-Art Reviews, Data Compilations, Technical Reports. Can be up to 530 alphanumeric characters for

each publication. This is a detail table: each Referral activity can list zero, one or many publications. However, for TR input, the total length cannot exceed 1800 characters. Validations: none.

Access and Charges

Text: Restrictions on who is permitted to access the collection or make use of this Referral activity and charges for use. Example: the Geological Survey library is open to the public. There is no charge for services other than photocopy. Its resources are made available to other government agencies, state geological surveys, academic institutions and research organizations. Can be up to 400 alphanumeric characters. This may be expanded, but for TR input, length cannot exceed 400 characters. No validations performed, but usually expected to be one of {DoD only, DoD and contractors, U.S. government only, U.S. government and contractors, no restrictions}, and a rate or list of fees and charges that may depend on type of user.

Coverage

Text: The period or the span of time of the material at hand. Example: 1944 to present. Can be up to 30 alphanumeric characters. This may be expanded, but for TR input, the length cannot exceed 32 characters. No validations performed, but usually expected to be of the form "yyyy to present."

Hours of Operation

Text: Regular hours of availability for the Referral activity. Example: 7:15am - 5:00pm EST, Monday-Friday. Can be up to 100 alphanumeric characters. Includes opening and closing hours and days of the week during which the facility is open. No validations performed but entries expected to be of this form.

Contract

Text: The contract number. Example: N01GM-2127. Can be up to 22 alphanumeric characters. This may be expanded, but for TR input, the length cannot exceed 70 characters. Validations: none.

Annotation

Text: A brief description of the activity, in free format. Example: The library supports the mission requirements of the Geological Survey scientists. Can be up to 820 alphanumeric characters. This may be expanded; however, for TR input, only 450 characters can be represented. The Geological Survey is one of the federal government's major earth science research and factfinding agencies. The Survey also maintains large branch libraries at its regional offices and at other field locations, and a photographic library at its regional center in Denver. Validations: None.

4.3.2   Outputs

Four sets of outputs are defined by the Referral Directory: the hardcopy Referral Data Bank Directory, the generation of similar printed output to accompany a data call, the tapes generated for updating the TR Database, and the online display provided by the Online Retrieval System and Input/Editing System to users. The differences among these four are strictly those of format and medium; the content is the

same. All fields are presented to all four sets of outputs except for two accommodations to the TR Database format.

The Hardcopy Referral Data Bank Directory and hardcopy for data calls are exhaustive listings of all information about each Referral. It will be possible to select specific Referrals for output, but different display formats will not be supported. The format used for printing the Referral Data Bank Directory will also be used for proofreading and providing offline listings for the purposes of a data call.

The tapes generated for updating the TR database provide a standard data interchange medium. All Referral information will be put into TR format and made available to DROLS users and via demand bibliographies. Two accommodations to TR will be supported. First, the TR Database is limited to 450 characters in field 30. The Referral annotations may be larger. Therefore, the first 450 characters of each annotation will be provided for the TR database. The TR database does not have a field for hours of operation. Therefore, this information will be appended to the annotation. If there isn't enough room for an individual Referral, it will be skipped. Other referrals will not be affected.

The most common output is anticipated to be the most convenient one: direct display of Referrals online by users at their terminals. Within DTIC, users will have access to the Input/Editing System. This will provide a means to examine Referral information in great detail. It will also allow hardcopy generation of individual Referrals for proofreading. End users will access the Referral Directory via the Online Retrieval System. Output will be presented by being displayed on terminal screens. All data elements will be displayed in the Full Detail format. Less information about each Referral will be displayed in the Medium and Short formats. Users will be able to choose

any of these formats at any time.

4.3.3   Data Base

The Referral Directory will be implemented as a relational database. The design specifies one master table: referral, and six detail tables: descriptor, language, poc (point of contact), descriptors, collection and services. They are all joined on the primary key: referral number. In the listing below, the data dictionary is shown in tabular format. The key for each table is indicated by a ● symbol.

REFERRAL		
● refnum	Integer	4
activity	Text	120
addr_line1	Text	60
addr_line2	Text	60
addr_line3	Text	60
addr_line4	Text	60
phone	Character	40
autovon	Character	40
fts	Character	25
fax	Character	20
lastmod	Date	
orgtype	Text	45
orgfunction	Text	30
contract	Text	22
coverage	Text	30
access	Text	400
hours	Text	100
annot	Text	820

COLLECTION		
● refnum	Integer	4
item	Text	700

SERVICES		
● refnum	Integer	4
service	Text	50

PUBLICATIONS		
● refnum	Integer	4
pub	Text	530

DESCRIPTOR		
● refnum	Integer	4
weight	Character	1
term	Text	50

LANGUAGE		
● refnum	Integer	4
lang	Character	20

POC		
● refnum	Integer	4
primary	Character	1
name	Text	40
title	Text	40

4.4   Program Descriptions

This section provides detailed information on proposed system implementation. Where possible module names will be specified. In all cases functionality will be identified, a description of the tools with which it will be implemented will be provided, and relationships between subsystems will be specified.

4.4.1   Online Retrieval System

Modules proposed for the Referral Directory Online Retrieval System:

Ident	Title/Function	Ref
retsys.qc	main program	4.4.1.1
top.qc	dispatcher; "top frame"	4.4.1.2
cmd.qc	search	4.4.1.3
genmain.c	generate QUEL	4.4.1.4
query.lex	lexical analysis of string	4.4.1.5
full.yacc	analyse search string	4.4.1.6
func.c	support for parsing	4.4.1.7
globals.qc	globally shared objects	4.4.1.8
defs.qc	globally known names	4.4.1.9
housekeep.qc	init., common functions	4.4.1.10
help.qc	help interface	4.4.1.11
bhq.qc	inline "back, help, quit"	4.4.1.12
whatnext.qc	what next dispatching	4.4.1.13
select.qc	select menu driver	4.4.1.14
browse.qc	browse dbname, org.	4.4.1.15
browsesubj.qc	browse subject	4.4.1.16
typedefs.qc	shared declarations	4.4.1.17
display.qc	three display formats	4.4.1.18

4.4.1.1a retsys

This will be a deliberately small module, just handling command-line parsing from main(). It will call init() in the housekeep module to open the database, initialize the forms, and clear all shared variables. Then it will turn over control to top().

4.4.1.2a top

This module will be the dispatching and event handling module. It will branch on user input to search by referral name, search by organization name, search by subject, or the corresponding browse modules. It will provide a top-level menu handler.

4.4.1.3a cmd

This module will implement the search interface. It will prompt for and accept a query, check that it is legal (e.g. "army or" is illegal), generate a QUEL qualification, execute the query to find referrals matching that qualification. If no referrals match, it will return control to top. If exactly one referral matches, it will give control directly to the full display. All other cases, will give control to whatnext(). This module will call support

routines legal() which in turn calls genqq() function in genmain.c to check legality, generate QUEL.

4.4.1.4a genmain.c

This module will provide separation of the user interface which collects the user's search terms, called by legal(), and the yacc grammar that parses them, called by yyparse (generated by yacc) in turn. The reason this is placed in a separate module is that it greatly facilitates testing of the c code generated by lex from query.lex and by yacc from full.yacc. This will be necessary when implementing mixed Booleans (e.g. "air force or navy", "(mouse or mice) and trap").

4.4.1.5a query.lex

This module will provide a lex specification that will perform lexical analysis on search string. It will separate Boolean operators "and" and "or" from the search terms, return them to the yacc grammar one by one as tokens. Note that there are no illegal tokens; they can only combine with each other in illegal ways, and that is judged by the yacc grammar, not lex.

4.4.1.6a full.yacc

This module will provide a yacc grammar that will accept term or Boolean operator from lexical analysis and check for a legal "sentence". E.g. "food or water" is legal, "food water or" is illegal. If legal, it will generate an appropriate QUEL qualification, save it, and then return control to caller.

4.4.1.7a func.c

This module will provide support functions for search functions. It will support separate compilation for standalone testing of lex and yacc.

4.4.1.8a globals.qc

This module will declare the shared data structures of the Online Retrieval system. This will include flags: is the database open, are the forms up? The quit() function will need this flag so it can clean up correctly. It will modularize state information. This will include the last operation, either a search or a browse. The short display and select functions need this so they can re-run the search correctly. Another key shared structure is the list of the referral numbers that matched the last search. The display functions (except short) will need this so they can display corresponding referrals as the user asks for them.

4.4.1.9a defs.qc

This module defines common symbols, manifest constants, and external definitions of the shared data structures.

4.4.1.10a housekeep.qc

This module will provide housekeeping functions. This will include initialization: zero-ing or clearing of shared data structures. It will also include title bar painting, putting messages to the screen, status messages while searching, range_iterate(): needed for self-join on search

	tables to implement general conjunction (and's) on details.
4.4.1.11a help.qc	This module will implement context sensitive help from any screen. It needs the help file name, which will be passed as an argument to do_help().
4.4.1.12a bhq.qc	This very short module will provide common inline code to implement consistent "Back Help Quit" menu items on each menu.
4.4.1.13a whatnext.qc	This module will implement the "what next" hub; dispatching to different display formats or returning to previous search or browse.
4.4.1.14a select.qc	This module will implement manual selection from a previous search or browse. It will re-run the previous search if possible, otherwise it will look up by referral number (from a previous browse or could also be a previous select). It will dispatch to all() to select display format unless exactly one referral is chosen; then it will send control to the full display.
4.4.1.15a browse.qc	This module will implement a simple dispatcher; it will allow fewer choices to be presented to the user at the top level. It will be called by top(); it will call the different browse types. Browse by referral name and browse by organization name will be implemented in this module because of their similarity; they all implement browsing on bound terms.
4.4.1.16a browsesubj.qc	Browse by subject will be implemented in a separate module because there are many more unbound subject terms than there are bound terms for the other types of browse. This requires a different load strategy to show good performance: do not load the entire table into the tablefield.
4.4.1.17a typedefs.qc	C lexical requirements require the global definitions to know about any typedefs used, but most functions need to include the defs in order to declare their types correctly. This does not usually come up because most type defs are private to a function or module. The Online Retrieval System needs a couple of global variables to have strictly defined enumerated types: search type in particular. This module will provide them.
4.4.1.18a display.qc	This module will implement the three display types: short, medium, and full. It will be called from whatnext() and select(); it calls no further modules.

4.4.2   Input/Editing System

Modules proposed for the Referral Directory Input/Editing System:

Ident	Title/Function	Ref
mqual.qc	main program system	4.4.2.1
systems.qc	Input/Editing functions	4.4.2.2
browse.qc	browsing system	4.4.2.3
edit.qc	editing system	4.4.2.4
functions.qc	common functions	4.4.2.5
globals.qc	global objects	4.4.2.6
input.qc	input system	4.4.2.7
tooldefs.qc	declarations of objects	4.4.2.8
tools.qc	applications of objects	4.4.2.9
genproof.qc	print individual referral	4.4.2.10
Makefile	generate hardcopy directory	4.4.2.11

4.4.2.1a mqual

This module will define the start of flow of control for the Input/Editing System. It will perform command-line parsing, set up forms and database access. It will call top() which dispatches to input, editing, and browsing modes.

4.4.2.2a systems

This module will provide functions common to editing, browsing, and input. It will implement functions masterquery() and fullquery(), which are called by all other parts of system that retrieve referral records.

4.4.2.3a browse

This module will implement a browser for all Referral fields. It will provide a safe method of examining Referrals, allows no changes. It will be called by top(), it will calls masterquery() and fullquery().

4.4.2.4a edit

This module will implement update for all Referral fields. It's main function do_edit()n will contain the logic for the validations/corrections cycle. It will be called by top, it will call do_edit(), do_edit_abstract(), and saymod().

4.4.2.5a functions

This module will contain all the utility functions called by all other modules. These will be mostly housekeeping functions: initialization and cleanup, zero-ing shared data structures, title bar painting, putting messages to the screen, status messages while searching.

4.4.2.6a globals

This module will declare globally known objects shared by other modules: flags, status codes, context for context-sensitive help, last query for select() to re-run the search, and the list of referrals matching last search.

4.4.2.7a input

This module will implement input of new referrals, will call major function fullappend() to allow user to input a new referral into the Directory. It will be called by top(), it will call fullappend().

4.4.2.8a tooldefs

This module will define two abstract data types: MTOOL and QTOOL, to be used throughout Input/Editing system.

Abstract Data Type QTOOL will be defined by its representation and by six operations one can perform on an object of its type: new, print, getform, putform, formquery, mdquery, and four more operations one can perform on an object of its type and related table(s) in the database: retrieve, append, delete, replace. Abstract Data Type MTOOL will be defined by its representation and by six operations one can perform on an object of its type: new, print, masterquery, fullquery, and four more operations one can perform on an object of its type and related table(s) in the database: retrieve, append, delete, replace, and by four "iterator" functions: mainmaster, submaster, maindetail, subdetail, and two informational functions: referential, pkey, and one very useful function: bldjoinqual, which implements multiple detail relationships.

4.4.2.9a tools	This module will implement the operations defined above on objects of type MTOOL and QTOOL.
4.4.2.10a genproof	This module will contain the logic to generate a laser print of an individual referral for proofreading.
4.4.2.11a Makefile	This module will contain the dependencies description that specifies how to rebuild the Input/Editing system from source or intermediate object code.

4.4.3   Generation of the Hardcopy Referral Data Bank Directory

The hardcopy Referral Data Bank Directory will be generated by a series of standalone programs connected with Unix pipes. The programs will use Unix software engineering tools for maximum program development productivity and application reliability. They will avoid trying to turn database managers into typesetters or vice versa.

The resulting pipeline will resemble a car assembly line. First, the main program *report.qc* will extract and sort referrals. It will pipe its output, the sorted referrals, into the next program *report.sed*. *Report.sed* will implement a text manipulation utility; it will insert formatting commands. *Report.sed* will pipe its output, the referrals now with embedded formatting commands, into the next program, the typesetter *troff*. The pipeline may be summarized:

extract --> insert formatting --> typeset --> print

or

report.qc --> report.sed --> troff --> lpr

The *troff* typesetting will be performed with the Adobe Transcript tool *psroff* which produces PostScript output suitable for driving an Apple Laserwriter. Thus final result will be accomplished with the pipeline:

report.qc --> report.sed --> psroff

Similar pipelines will generate the three indices: Referral Activity Name, Points of Contact, and Subject. The main program *refname.rw*, *pocname.rw*, or *subject.rw* will extract and sort the information. It will pipe its output into a program

alphabreak.sed which will generate special formatting to handle alphabetical breaks in the indices. In turn *alphabreak.sed* will pipe its output into a program *successive.awk* which will remove successive page references (e.g. will transform "1, 5, 11, 12, 13, 14" into "1, 5, 11-14"). Finally, *successive.awk* will pipe its output into the typesetter. The pipeline may thus be summarized:

> extract --> alpha breaks --> remove successive --> typeset --> print
>
> or
>
> *subject.rw --> alphabreak.sed --> successive.awk --> psroff*

This will generate the Subject Index. To generate the Referral Activity Name or Points of Contact indices, *subject.rw* wil be replaced by *refname.rw* or *pocname.rw* respectively.

Modules proposed for generating the hardcopy Referral Data Bank Directory:

Ident	Title/Function	Ref
report.qc	main program	4.4.3.1
report.sed	adds formatting cmds	4.4.3.2
header	common formatting cmds	4.4.3.3
subject.rw	gen subject index	4.4.3.4
refname.rw	gen referral name index	4.4.3.5
pocname.rw	gen poc name index	4.4.3.6
pre-rw-refname	gen refname.rw	4.4.3.7
pre-rw-poc	gen pocname.rw	4.4.3.8
alphabreak.sed	alpha breaks, indices	4.4.3.9
successive.awk	repeat page refs, indices	4.4.3.10

4.4.3.1a report.qc

This module will be an EQUEL/C program. It will generate the citations for the hardcopy Directory. It will use the INGRES relational engine to perform most of the low level handling, such as extracting and sorting. It will generate "hooks" to be used to attach to or substitute for formatting commands later in the pipeline. This program will comprise the main data extraction program.

4.4.3.2a report.sed

This module will be a sed script. Its input will be the output of report.qc. It will use the hooks left by report.qc to decide where to embed formatting commands in the text stream. It will also search for specific Referral information and embed formatting commands around it to (later) cause bolding and font size changes.

4.4.3.3a header

This module will provide a set of formatting commands common to the citations: set-up, defaults, and initialization for type styles and sizes, page offsets, margins, and running headers and footers.

4.4.3.4a subject.rw | This module will be an INGRES report specification to generate the subject index. It will extract and sort the keyword descriptors for all referrals. It will not format output for direct printing or even for input to the typesetter -- this is left to the programs in the pipeline between it and the typesetter: alphabreak.sed and successive.awk. It will generate hooks for their use, however. Principally, it will apply the "break" tool of the INGRES report writer to finding the alphabetical breaks.

4.4.3.5a refname.rw | This module will be a similar INGRES report specification to generate the Referral Name index. It will be generated automatically from subject.rw by a sed script in pre-rw-refname. This may be viewed as report-generation-generation. Pre-rw-refname generates the report specification refname.rw. INGRES generates the report from the specification in refname.rw. The motivation is the ability to keep each index's styles and formatting consistent with the others' by deriving the report specifications for the others from subject.rw.

4.4.3.6a pocname.rw | This module will be a similar INGRES report specification to generate the Points of Contact index. It will be derived from subject.rw similarly.

4.4.3.7a pre-rw-refname | This module will be the sed script that generates refname.rw from subject.rw. It may be used as described above to propagate modifications of the Subject index to the Referral Name index.

4.4.3.8a pre-rw-org | This module will be a similar sed script to generate orgname.rw from subject.rw.

4.4.3.9a alphabreak.sed | This module will be a sed script to handle the formatting for alphabetic breaks.

4.4.3.10 successive.awk | This module will be an awk script to remove repeated page references from indices. It will collapse repeated page references as a good human indexer would. For example:

from	to	rule
1,5,11	1,5,11	*none successive, no change*
1,5,11,12,13,14	1,5,11-14	*collapse 11 through 14*
1,2,5,6	1,2,5,6	*only two successive, do not collapse*
9,14,15,16,20	9,14-16,20	*three or more, collapse repeats*

4.4.4   Generation of tape for TR Database update

This module will be a short standalone EQUEL/C program. It will extract Referrals from the Directory and write them to tape. Its most complex operation will be error recovery in case the tape drive is offline.

Appendix A: Online Retrieval System Menu Flowchart
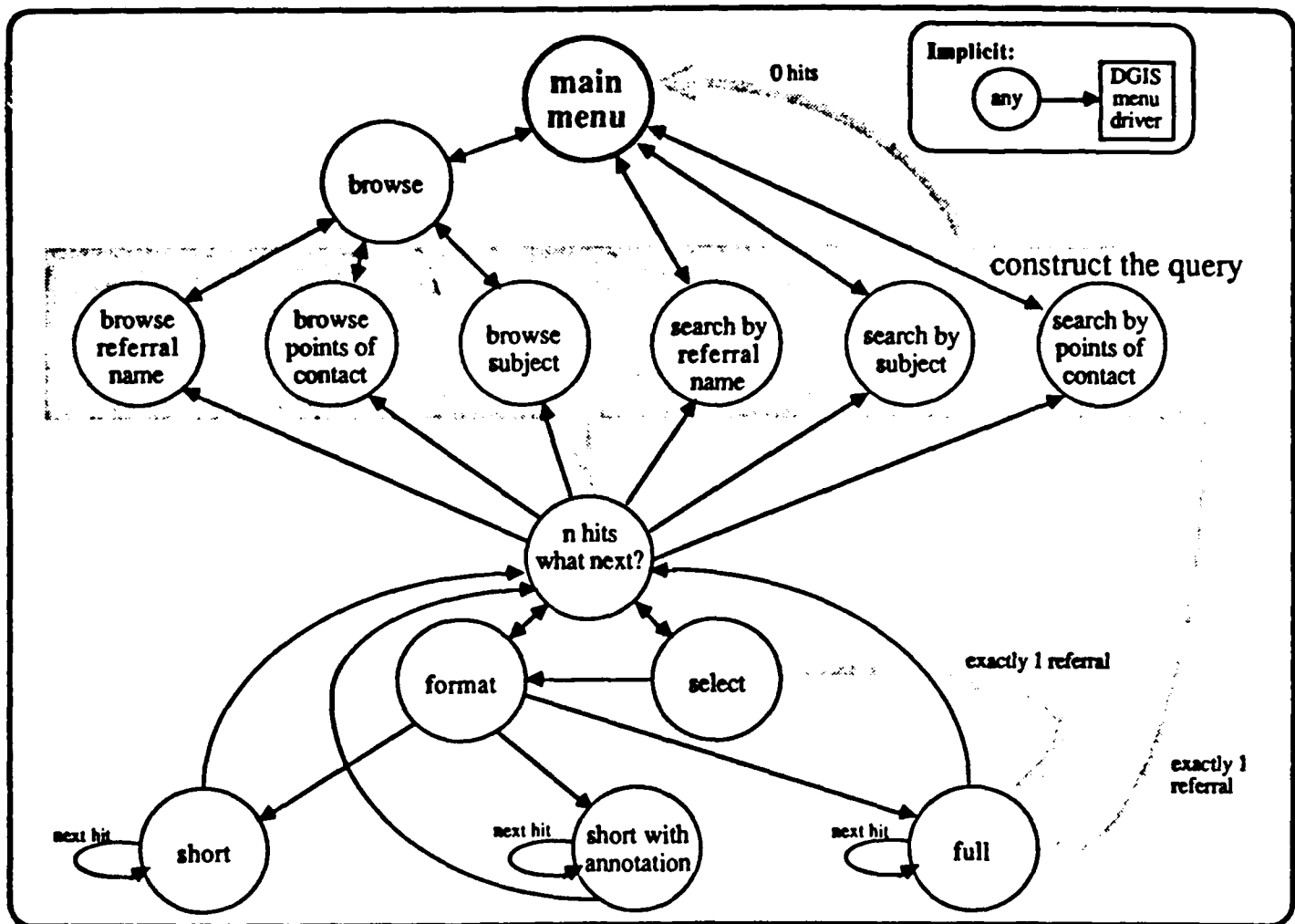
REFERRAL NUMBER: 990510

Referral

Name	Aberdeen Proving Ground, Testing Directorate Measurements and Analysis Division
Address	Code STEAP-MT-G, Aberdeen Proving Ground, MD 21005
Contacts	Barnhart, Henry; Whallon, J. K., Chief

Phone Numbers

Commercial	(301) 278-2134
AUTOVON	283-2134
FTS	_____
FAX	_____

Organization

Affiliation	Army
Function	Testing Facility

Contract _____

Languages _____

Coverage (Dates) _____

Collection The testing facility has approximately 400 entries, stored on IBM punch cards; and computer printouts of curves for pressure, velocity, and travel for weapons, projectiles, and charge combinations.

Hours of Operation _____

Access and Charges Services are available to DoD agencies on a need-to-know basis. Requests involving a significant expenditure of manhours require reimbursement.

Services analysis, consultation, data compilation, evaluation, referral, testing

Publications Technical Reports

Descriptors ammunition; artillery; ballistic testing; mathematical analysis; mortars; pressure; *projectile trajectories; *projectiles; recoilless guns; rifles; *spinning (motion); velocity

Annotation The Measurements and Analysis Division, Materiel Testing Directorate, develops techniques and procedures for accumulation and analysis of ballistic data, provides advisory services for ballistic problems, and analyzes and processes data from ballistic test records and prepares related reports. Directorate reports are available from DTIC.

REFERRAL NUMBER: 990515

Referral

Name	Aberdeen Proving Ground, Materiel Testing Directorate Methodology and Instrumentation Division
Address	Code STEAP-MT-M, Aberdeen Proving Ground, MD 21005
Contacts	Binney, Charles W., Col, Director; Resch, Donald, Associate Director; Somody, Edward V., Chief, MTM

Phone Numbers

Commercial	(301) 278-2740/3478/2734
AUTOVON	283-2740/3478/2734
FTS	_____
FAX	_____

Organization

Affiliation	Army
Function	Testing Facility

Contract	_____
Languages	_____
Coverage (Dates)	_____
Collection	The testing facility is served by the BRL Technical Library.
Hours of Operation	_____
Access and Charges	Access is limited to DoD and other qualified agencies and institutions with a need-to-know. It provides RD advice to proponent agencies and developers.
Services	analysis, consultation, data compilation, evaluation, referral
Publications	Technical Reports
Descriptors	*Army equipment; air conditioning equipment; *ammunition; *ammunition components; *armor; *combat vehicles; electronic equipment; explosive charges; fire control systems; generators; grenades; guided missiles; *materiel; mines (ordnance); mortars; pyrotechnics; recoilless guns; rockets; surface properties; tanks (combat vehicles); target acquisition; test equipment; test methods; transport properties; *weapon systems; *weapons
Annotation	The Materiel Testing Directorate plans, conducts, and reports on tests of weapons, weapons systems, rockets and guided missiles, fire control, target acquisition, ammunition and munitions components, combat vehicles and general Army equipment; and inspects and issues armor plate for all Army materiel combat ammunition tests. Research and test results are given in technical reports and are available from DTIC or the BRL Technical Library located at Aberdeen Proving Ground, MD, to qualified users. The Materiel Testing Directorate does not furnish copies of reports.

REFERRAL NUMBER: 990538

Referral

Name	Air Force Academy Library
Address	Code DFSEL, Colorado Springs, CO 80840
Contacts	Barrett, Donald J., Assistant Director; Schaeffer, Reiner H., LtCol, Director
Phone Numbers	
Commercial	(303) 472-2590/4406
AUTOVON	259-2590/4406
FTS	_____
FAX	_____

Organization

Affiliation	Air Force
Function	Academic Library
Contract	_____
Languages	_____
Coverage (Dates)	_____

Collection The academic library has approximately 320,000 books; 84,000 bound periodicals; 130,000 government documents; 4,500 phonograph records; 390,000 reports (AD and NASA) on microfiche; 20,000 hard copy reports; 2,000 maps; and 2,300 journal, serial, and newspaper subscriptions. Book and periodical holdings are primarily commercial publications in the English language. It has no security classified publications. Special collections cover archival material on the Academy, Col. Richard Gimbel Aeronautics History Collection of 20,000 items, papers of some Air Force leaders, and falconry.

Hours of Operation _____

Access and Charges The academic library primarily serves Academy personnel. Outside users require permission of the library director.

Services duplicating, loans (interlibrary), reference, referral

Publications Bibliographies; Handbook; New Book List (monthly)

Descriptors Air Force training; aerial warfare; *aeronautics; air defense; aircraft; *astronautics; chemistry; civil engineering; computers; cost effectiveness; defense systems; economics; education; electrical engineering; flight training; guided missiles; history; humanities; law (jurisprudence); leadership; life sciences; logistics; management; mathematics; mechanics; military applications; military operations; military strategy; military tactics; physics; political science; psychology; science; social sciences; sociology; spacecraft; technology; weapon systems

Annotation The Air Force Academy Library is an undergraduate academic library supporting the cadet curriculum with special emphasis on aeronautics, military art and science, basic and applied sciences, technology, social sciences, and humanities.

990500
Aberdeen Proving Ground, Materiel Testing
  Directorate Artillery and Armor Division
ATTN: Romanell
Code STEAP-MT-A
Aberdeen Proving Ground, MD 21005

#990510
Aberdeen Proving Ground, Testing Directorate
  Measurements and Analysis Division
ATTN: J. K. Whallon
Code STEAP-MT-G
Aberdeen Proving Ground, MD 21005

#990515
Aberdeen Proving Ground, Materiel Testing
  Directorate Methodology and Instrumentation
  Division
ATTN: Charles W. Binney
Code STEAP-MT-M
Aberdeen Proving Ground, MD 21005

#990520
Army Health Care Studies and Clinical
  Investigation Activity
ATTN: David A. Mangelsdorff
Health Services Command
HSHN-Z, Bldg. 2268
Ft. Sam Houston, TX 78234

#990525
Academy of Health Sciences, Stimson Library
ATTN: B. Huber
Ft. Sam Houston, TX 78234

#990530
Advisory Group on Electron Devices
ATTN: David Slater
OUSDR&E
201 Varick Street
New York City, NY 10014

#990535
Aerospace Structures Information and Analysis
  Center (ASIAC)
ATTN: Catherine I. Wolf
Code AFWAL/FIBRA
Wright-Patterson AFB, OH 45433

#990536
Agency for International Development Library
ATTN: M. S. Pope
Room 105SA-18
320 21st St, NW

Washington, DC 20523

#990538
Air Force Academy Library
ATTN: Reiner H. Schaeffer
Code DFSEL
Colorado Springs, CO 80840

#990541
Air Force Aerospace Medical Research
  Laboratory
ATTN: K. M. Zimmerman
Wright-Patterson AFB, OH 45433-6573

#990545
Air Force Armament Division
ATTN: Mel Fowler
Code DLOD/STINFO
Air Force Systems Division
Eglin AFB, FL 32542

#990550
Air Force Armament Laboratory
ATTN: June C. Stercho
Eglin AFB, FL 32542

#990554
Air Force Ballistic Missile Office, Advanced
  Basing Division
ATTN: M. Norton
HQ BMO/MYEB
Norton AFB, CA 92409-6468

#990555
Air Force Wright Aeronautical Laboratories
ATTN: Jackie Doben
Code AFWAL/TST
Wright-Patterson AFB, OH 45433

#990556
Air Force Ballistic Missile Office, Advanced
  Systems Division
ATTN: S. W. Opel
HQ BMO/MYES
Norton AFB, CA 92409-6468

#990557
Air Force Ballistic Missile Office
  Maneuvering Reentry Vehicle Program
ATTN: A. D. Wassil-Grimm
HQ BMO/MYEG
Norton AFB, CA 92409-6468

#990558

Air Force Ballistic Missile Office
  Penetration Aids Division
ATTN: W. B. Duncan
HQ BMO/MYEP
Norton AFB, CA 92409-6468

#990559
Air Force Ballistic Missile Office
  Technology Flight Test Branch
ATTN: B. H. Smith
HQ BMO/MYES
Norton AFB, CA 92409-6468

#990560
Defense Audiovisual Agency, Motion Media
  Depository
ATTN: Robert Laur
Code DAVA-N
Norton AFB, CA 92409

A

991235, 991245, 991258, 991275,
991439, 991583, 991659-991661,
991776, 991790, 991795, 991804,
991805, 992135, 992225

aircraft ammunition   990545, 990550, 990738

aircraft cabins   991439

aircraft carriers   991790, 991795

aircraft defense systems   990545, 990555, 990965,
991805, 991935

aircraft engines   990555, 990715, 990737, 990738,
990740, 991011, 991013, 991073,
991085, 991790, 991800

aircraft equipment   990585, 990715, 990737,
990738, 990740, 990768, 991011,
991013, 991073, 991495, 991660,
991795, 991805, 992225

aircraft fire control systems   990545, 990550,
990740

aircraft fires   990688

aircraft flares   990550

aircraft guns   990545, 990550, 990715, 992235

aircraft heaters   991073

aircraft landings   990585, 991790, 992225

aircraft maintenance   991210, 991802

airframes   990535, 990715, 990737, 991011,
991013, 991085, 991804

airglow   991735, 991985

airplane engine heaters   991073

airplane models   991085

airplanes   990585, 990738, 990740, 991011,
991013, 991055, 991085, 991804

airports   990568

airspeed   990585

airworthiness   990737

alcohol consumption   991439, 991685

alcoholism   991387, 991685, 991855

all weather aviation   990737, 991805, 991840

allergic diseases   991230

allocations   991720

alloys   990555, 990644, 990645, 991113, 991254,
991315, 991615, 991630, 991777,
992080, 992098, 992160

almanacs   991874

alpha particles   992000, 992070

altimeters   990750

altitude   991439, 991780, 991785

aluminum oxides   992093

amino plastics   992055

ammunition   990510, 990515, 990718, 990721,
990725, 990770, 990905, 990915,
990965, 990990, 991013, 991025,
991055, 991075, 991115, 991295,
991500, 991580, 991605, 991903,
991915, 992235

ammunition components   990515, 990550, 991500,
991580

ammunition propellants   991165

amphibious operations   991275, 991611, 991612,
991809, 991830, 991910, 991935,
991943, 991944, 991975

amphibious ships   991809

amphibious vehicles   991050, 991809, 991830

amplifiers   990530, 991500

analgesics   990930

analogs   991682

analysis of variance   990880, 991145, 991680

analytic geometry   991489

analytical chemistry   991981

anatomy   991230, 991625, 991737, 992065

anchors   991175

anchors (structural)   991175

anemias   991825

anesthesia   991230, 991590

angle of attack   990585

angles   991120

animal husbandry   991294, 991776

animals   991294

anions   991335, 991573

anodes   991335

antarctic regions   991570

antenna arrays   992105

antenna components   991340

antenna radiation patterns   991900, 991925

antenna windows   990556

antennas   990566, 990695, 990750, 990806,
991030, 991115, 991900, 992105,
992134

anthropology   991380, 991435

anthropometry   990541, 991000, 991075, 991515

anti-intrusion devices   991075

antiaircraft ammunition   991580

atmospheric physics   990620, 990625, 991090,
        991370, 991659, 991660, 991725,
        991735, 991748, 991775

atmospheric precipitation   991075, 991740, 991746

atmospheric sciences   991900

atmospheric sounding   991090

atmospheric temperature   991740

atmospherics   990590, 990595, 990620, 990625,
        990660, 990806, 991748, 991749,
        991767, 991910, 991983

atomic energy levels   991100

atomic orbitals   991100

atomic properties   990620, 990625, 991100,
        991105, 991110, 991200, 991573

atomic spectra   991100

atomic spectroscopy   991100, 991105, 991110,
        991777

atomic structure   991100

atoms   991095, 991100, 991110, 991137, 991573

attack aircraft   990738

attack helicopters   991013

attenuation   992039

attitude (inclination)   991015, 991955

attitudes (psychology)   990520, 990600, 991150,
        991430, 991520, 991705

attrition   990600, 991015

audiometry   991780

audiovisual aids   990735, 991065, 991260, 991405

auditory perception   991905

augers   992173

aurorae   991735

autogyros   991013

automatic   991047, 991405, 992154

automatic pilots   991805

automatic test equipment   991795

automation   990561, 990880, 991251, 991405,
        991495, 991557, 991950

automobile exhaust   990640

automotive engineering   991050, 991776

auxiliary   990915, 991200, 991660

auxiliary power plants   991085, 992060

aviation accidents   990688, 991439, 991785

aviation fuels   990555, 991011

aviation medicine   990685, 990688, 990975,
        991439, 991625, 991780, 991785,
        991790, 992110

aviation personnel   990738, 991780, 991785,
        991790, 992110

aviation safety   990545, 990585, 990685, 990688,
        990738, 991011, 991013, 991439,
        991790

avionics   990555, 990715, 990737, 990750,
        991011, 991475, 991795, 991804,
        991812

awards   991505, 991947

azimuth   991730

B

bacteria   990980, 991820

bacterial aerosols   990640

bacterial diseases   991820

bacteriology   990980, 991155

badges   991565

ballast   991175

ballistic missile submarines   991905, 991925

ballistic testing   990500, 990510

ballistics   990550, 990556, 990721, 990900,
        990905, 990945, 991115, 991900,
        991903, 991910, 991915

balloon equipment   991767

balloons   990595, 991767

barometric pressure   991744

. . . .

W

Washington (state)   990855

Western United States   991143

wake   990655

war games   990795, 990900, 991015, 991235, 991275, 991612, 991712, 991932

war potential   991045

warehouses   991130, 991275

warfare   990560, 990725, 990758, 990759, 990795, 990982, 991015, 991192, 991611, 991612, 991860, 991932, 991944, 991947

warheads   990550, 990721, 991500, 991903, 991910, 991935, 992085

warning systems   990545, 990566, 990690, 990755, 990915, 991008, 991167, 991260, 991612

waste disposal   990640, 990644, 990821, 990838, 990970, 991185, 991504, 991772, 992004, 992138

waste gases   990640

waste management   990821, 990890, 991243, 991504, 991772

waste recycling   992103

waste treatment   990568, 990821, 990970

waste water   990821, 990822, 990838, 990848, 990863, 991185, 991772, 992015, 992049, 992103, 992200

wastes   990568, 990640, 990644, 990820, 990890, 990970, 991113, 991504, 992093, 992098, 992103, 992177

wastes (industrial)   990640, 992098

wastes (sanitary engineering)   990640, 991175, 991254

water   990605, 990995, 991143, 991362, 991545, 991560, 991720, 991781-991783, 992010, 992177, 992200

water conservation   991143, 991772

water erosion   990819

water flow   990862, 991782, 991783

water pollution   990820, 990825, 990847, 990970, 991175, 991254, 991361, 991362, 991364, 991560, 991772, 991777, 992103, 992200

water pollution abatement   990821, 990822, 990838, 990862

water quality   990568, 990822, 990838, 990861, 990862, 991361, 991362, 991781, 991782, 992025, 992200

water reclamation   991143, 992200

water resources   990815, 990819, 990821-990823, 990827, 990828, 990830, 990833, 990835, 990837, 990838, 990847, 990848, 990850, 990861-990865, 990870, 991143, 991294, 991491, 991545, 991560, 991781-991783, 992200

water supplies   990725, 990820, 990821, 990847, 990862, 991185, 991275, 991545, 991560, 991765, 991781-991783, 992200

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weapons effects   990885, 991290

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weather forecasting   990595, 991740, 991847

weather modification   990595

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weightlessness   991785, 992110

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wheels   990915

whiskers (crystals)   991220

whole body irradiation   990675

wildlife   990848, 990855, 990861, 991460

wind   991740, 991744, 991847

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wound ballistics   991115

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            991736, 992020, 992185

writing   991415, 991437

zoology   991570, 991737

X

x-ray absorption analysis   992039

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Y

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Z

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A

Abel, Evelyn   991525

Absetz, Margaret V.   992180

Acchiome, Lawrence J.   991985

Adams, Linda M.   992136

Aitel, Grace   991263

Albert, T.   991326

Alexander, Carolyn I.   990770

Alexander, Mary   992006

Allard, Dean C.   991860

Allen, J. H.   991735

Allinson, Sally   990670

Altrock, Dick   991774

Anderson, Carol   990759

Anderson, Charles H.   990890

Anderson, J. B.   991790

Anderson, Mary   990864

Anderson, Peter J.   991570

Andrews, J. E.   991879

Appler, D.   991504

Arnett, James L.   990960

Arnitz, William E.   991495

Asay, Laura J.   990837

Asbury, H. O.   991662

Atwater, Virginia P.   991034

Austin, Richard H.   990905

Auton, D. L.   992075

Autry, Jean   990710

B

Baddour, G. A.   991225

Baer, D.   992060

Bailey, John G.   991140

Bainbridge, Ross   991557

Bargeski, Albert   991750

Barkhaw, H.   991363

Barnhart, Henry   990510

Barravecchia, Mary   991930

Barrett, Donald J.   990538

Barry, R. G.   991735

Bartl, Richard   992148

Basileo, M. A.   991747

Baughman, G. L.   991361

Baum, S.   991146

Beary, Eugene G.   991000

Beaumariage, D. C.   991747

Beavin, D.   991364

Beers, Fern   992138

Belt, J. R.   991254

Benny, J. A.   991835

Berger, M. J.   992039

Berger, Patricia W.   991668

Bernstein, F. C.   991137

Bertina, B. C.   991192

Bertsch, M. L.   991650

Best, E. J.   992150

Betts, A. M.   990536

Bialecki, Anthony G.   990625

Biersner, R. J.   991815

Biesecker, J. E.   991326

Bilofsky, H.   991489

Bingham, C. D.   991981

Binney, Charles W.   990515

Birnbaum, G.   991666

Bivins, R.   991662

Black, Bernice B.   990885

Blackman, Jerome A.   990785

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W

Wade, D. M.   991665

Wagg, R. A.   990737

Walker, R. F.   991341

Wall, Vincent E.   992135

Wallace, C.   991310

Wallace, Katharine   991885

Wallace, Katherine   991915

Walsh, R. J.   990998

Walter, G. D.   991270

Walters, D.   991772

Walz, Garry R.   991387

Wangemann, Robert T.   990890

Ward, M.   991292

Wardwell, R. S.   991650

Ware, Lawrence L.   990975

Warner, J.   992060

Wassil-Grimm, A. D.   990557

Wassom, John S.   991345, 991360, 991372

Watlington, Joyce   991515

Watson, Georgianna   991645

Waxman, R. E.   991840

Webber, D. W.   991143

Webber, Sylvia J.   990936

Weinles, Carol   991903

Weisman, Stuart   991198

Weiss, Egon   991645

Weisz, John D.   991515

Wente, Van A.   991660

Werk, William R.   990806

Wert, Barbara   990620

West, Oriana Brown   990825

Westbrook, Edwin   992145

Westerhout, G.   991874

Weston, Janice   991008

Wettack, John J.   990800

Whalen, Thomas C.   991130

Whallon, J. K.   990510

White, O. L.   991613

White, Richard M.   991658

Whitfield, Bradford L.   991360, 991372

Wiese, W. L.   991105, 991110

Wilde, D. U.   991983

Wildemuth, Barbara   991430

Wilhoit, R. C.   992155

Wilkinson, J. B.   991802

Williams, Larry   992145

Williams, Marilyn   990643

Williams, O. O.   991782

Williams, T.   990556

Williamson, M. W.   991738

Williamson, Robert   990688

Wilson, J. L.   990756

Wimsatt, Sara   991980

Winslow, Susan   992170

Wintz, Edward K.   990880

Wirick, Helen   991770

Wolf, Catherine I.   990535

Wood, J. T.   991673

Woodson, William B.   990715

Y

Yff, Joost   991425

Yolken, H. T.   991666

Yoshikawa, H. H.   991499

Z

Zaker, T. A.   991295

Zeidlik, Hannah   990758

Zeller, M.   991662

Zimmerman, K. M.   990541

Zirker, Jack   991774

Zissis, George   991555

Zoellner, J. A.   991340

Zuck, Thomas F.   991585

A

Army Center for Tactical Computer Systems
990047

Army Center of Military History Library   990759

Army Center of Military History, Historical Records
Branch   990758

Army Chaplain Center and School, Library   990760

Army Cold Regions Test Center   990768

Army Combat Development Experimentation Center,
Technical Information Center   990770

Army Combat Surveillance and Target Acquisition
Laboratory   990775

Army Combined Arms Support Laboratory   990756

Army Communications Systems Center   990785

Army Computer Systems Command, Technical
Library   990790

Army Construction Engineering Research
Laboratory   990800

Army Electronics Research and Development
Command, Technical Support Activity
990806

Army Electronics Technology and Devices
Laboratory   990810

Army Engineer District   990825

Army Engineer District, District Library   990815,
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Army Engineer District, Technical Library   990819,
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990830, 990833, 990835, 990837,
990838, 990840, 990847, 990848,
990850, 990855

Army Engineer District, Technical library   990870

Army Engineer Division, Lower Mississippi Valley,
Technical Library   990860

Army Engineer Division, New England, Technical
Library   990861

Army Engineer Division, North Atlantic, Technical
Library   990862

Army Engineer Division, North Central, Library
990863

Army Engineer Division, South Pacific, Technical
Library   990864

Army Engineer Division, Southwestern, Technical
Library   990865

Army Engineer School, Library and Learning
Resources Center   990875

Army Engineer Topographic Laboratories   990880

Army Engineer Waterways Experiment Station,
Library Branch, Technical Information

Center   990885

Army Environmental Hygiene Agency   990890

Army Field Artillery Board   990895

Army Field Artillery School, Morris Swett Library
990900

Army Foreign Science and Technology Center
990905

Army Health Care Studies and Clinical Investigation
Activity   990520

Army Hospital, Health Sciences Library   990910

Army Infantry Board   990915

Army Infantry School Library   990920

Army Institute of Dental Research   990930

Army Institute of Surgical Research   990935

Army Intelligence Center and School Library
990936

Army Intelligence School, Library and Information
Services Division   990937

Army JFK Special Warfare Center, Marquat
Memorial Library   990938

Army Large Caliber Weapons Systems Laboratory,
Energetic Materials Division   991341

Army Logistics Library   990942

Army Materials and Mechanics Research Center,
Technical Library   990945

Army Materiel Development and Readiness
Command, Headquarters Technical
Library   990950

Army Materiel Development and Readiness
Command, Technical Industrial Liaison
Office   990955

Army Materiel Systems Analysis Activity   990965

Army Medical Bioengineering Research and
Development Laboratory   990970

Army Medical Research Institute of Chemical
Defense, Wood Technical Library
992215

Army Medical Research Institute of Infectious
Diseases (USAMRIID)   990980

Army Medical Research and Development
Command   990975

Army Military History Institute   990982

Army Military Police School, Technical Library
990985

Army Missile and Munitions Center and School,
Library   990990

Army Natick Research and Development Center,
Systems Analysis and Concept

Development   990998

Army Natick Research and Development
        Laboratories, Technical Library
        991000

Army Nuclear and Chemical Agency   991003

Army Operational Test and Evaluation Agency
        991005

Army Ordnance Center and School, Library
        991008

Army Research Institute for the Behavioral and
        Social Sciences, Technical Information
        Center   991015

Army Research Institute of Environmental Medicine
        991020

Army Research Office   991025

Army Research and Technology Laboratories
        (AVRADCOM), Ames Research
        Center   991011

Army Research and Technology Laboratories
        (AVRADCOM), Applied Technology
        Laboratory   991013

Army Russian Institute, Library   991027

Army Safety Center   990688

Army Satellite Communications Agency   991030

Army Sergeants Major Academy, Library and
        Learning Resources Center   991034

Army Signal Center, Conrad Technical Library
        991040

Army Soldier Support Center Library System
        990680

Army Tank-Automotive Research and Development
        Center, Technical Information Office
        991050

Army Test and Evaluation Command, Technical
        Information Center   991055

Army Training and Doctrine Command (TRADOC),
        Technical Library   991060

Army Transportation School, Library   991070

Army Troop Support and Aviation Materiel
        Readiness Command   991073

Army Tropic Test Center, Fort Clayton (Panama)
        991075

Army War College, Library   991080

Arnold Engineering Development Center   991085

Assessment and Information Services Center
        991370

Atmospheric Sciences Laboratory   991090

Atomic Collision Cross Section Data Center
        991095

Atomic Energy Levels Data and Information Center
        991100

Atomic Line Shapes and Shifts Data Center
        991105

Atomic Transition Probabilities Data Center
        991110

Avondale Research Center   991113

B

Ballistic Research Laboratories   991115

Battelle Project Management Division, Library
        991116

Belvoir Research and Development Center,
        Technical Library   990995

Benet Weapons Laboratory, Technical Library
        991117

Berkeley Particle Data Center   991120

Brookhaven National Laboratory, Protein Data Bank
        991137

Brooks Army Medical Center, Medical Library
        991135

Bureau of Reclamation, Engineering and Research
        Center Library   991143

Bureau of the Census   991145

Bureau of the Census, Center for International
        Research   991146

C

Carbon Dioxide Information Center   991148

Center for Disease Control, Library   991155

Center for Energy and Environmental Information
        991365

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T

Tactical Technology Center   992145

Tactical Weapon Guidance and Control Information
        Analysis Center   992148

Tennessee Valley Authority (TVA), Knoxville
        Technical Library   992150

Texas Engineering Experiment Station,
        Thermodynamics Research Center
        992155

Toxicology Data Bank   991243

Toxicology Information Response Center (TIRC)
        992170

Transportation Research Information Services
        992171

Tri-Service Medical Information Systems (TRIMIS)
        992172

Tuscaloosa Research Center   992177

Twin Cities Research Center   992173

U

US Geological Survey, Library   991491

W

Walson Army Community Hospital, Medical Library
        992180

Walter Reed Army Institute of Research   992185

Walter Reed Army Medical Center   992190

Water Resources Scientific Information Center
        992200

Water Resources Support Center, Port Facilities
        Branch   991130

Western Space and Missile Center   992135

Western Space and Missile Center, Technical
        Library   992134

White Sands Missile Range, Technical Library
        992210

Wilford Hall USAF Medical Center (WHMC)
        992213

World Data Center of Oceanography   992220

Wright Aeronautical Laboratory, Technical Library
        992225

Y

Yuma Proving Ground, Technical Library   992235

TR Database Fields used by Referral Activities

TR field	Length	Description	Referral use
1	8	DTIC Accession Number	Accession Number
2	450	Fields and Groups	N/A
3	1	Entry Classification	always U
4	12	NTIS Prices	N/A
5	116	Source Name	Activity Name
6	450	Unclassified Report Title	Address and Phone Numbers: Commercial, AUTOVON, FAX, and FTS
7	450	Classified Report Title	N/A
8	1	Report Title Classification	always U
9	120	Descriptive Note	N/A
10	620	Personal Authors	Points of Contact
11	24	Report Date	Date of Last Update
12	8	Pagination	N/A
13	0	Blank Field	N/A
14	70	Source Report Series Number	Organization Type (Service, Function)
15	70	Contract or Grant Number	Contract Number
16	70	Project Number	Languages
17	70	Task Number	Languages
18	24	Monitor Acronym	Coverage
19	32	Monitor Series Number	N/A
20	1	Report Classification	always U
21	600	Supplementary Note	Collection
22	400	Distribution Availability Statements	Access and Charges
23	1200	Posting Terms	Descriptors
24	1	Posting Terms Classification	always U
25	1200	Candidate Posting Terms	Services
26	1	Candidate Posting Terms Classification	always U
27	1800	Abstract	Publications
28	1	Abstract Classification	always U
29	4	Initial Inventory	N/A
30	450	Index Annotation	Referral Annotation
31	1	Circle Special Indicator Codes	N/A
32	10	Circle Security Group Number	N/A
33	10	Limitation/Availability Codes	N/A

Organizational Impacts

The following chart lists the organizations participating in Referral Directory development.

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                    ┌─────────────────┐
                    │    Activity     │
                    └─────────────────┘
                             ▲
                             │
  ┌─────────────────┐              ┌─────────────────────────┐
  │ DTIC-F          │              │ DTIC-H                  │
  │ Gather          │─────────────▶│                         │
  │ Assign AD       │              │ Assign Source Codes     │
  │ Index           │              │ Input                   │
  │ Catalog         │              │                         │
  └─────────────────┘              └─────────────────────────┘
          ▲                                     ▲
           ╲                                   ╱          ┌──────────────────────┐
            ╲                                 ╱           │ DTIC-Z               │
  ┌──────────────────────────────────────────┐          │                      │
  │        Referral Directory                 │          │ Validate             │
  │                                           │          │ Provide printout     │
  │              DGIS                         │          │    for edit          │
  └──────────────────────────────────────────┘          └──────────────────────┘
                       │
                       ▼
  ┌──────────────────────────────────────────────────────────┐
  │ UNISYS                                                     │
  │ 1100/82              ╭────────╮        ╭────────╮          │
  │              ┌──────▶│  RTIS  │───────▶│ Current│          │
  │              │       │  file  │        │  File  │          │
  │              │       ╰────────╯        ╰────────╯          │
  │  ┌────────┐  │            │                                │
  │  │  TRIS  │──┘            ▼                                │
  │  └────────┘        ╭────────────╮                         │
  │                    │ candidates │                         │
  │                    │ for update │                         │
  │                    ╰────────────╯                         │
  │                          │                                │
  │                          ▼                                │
  │                      ◇◇◇◇◇◇◇◇◇◇◀──────────────────────────┤
  │                          │                                │
  │                          ▼                                │
  │                   ╭──────────────╮                        │
  │                   │ TR Database  │                        │
  │                   ╰──────────────╯                        │
  └──────────────────────────────────────────────────────────┘
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